Welcome to your CDP Water Security Questionnaire 2019

W0. Introduction

W0.1

(W0.1) Give a general description of and introduction to your organization.

First Solar, Inc. is a leading global provider of comprehensive photovoltaic (PV) solar energy solutions with over 20 gigawatts (GW) shipped worldwide. We design, manufacture, and sell PV solar modules with an advanced thin film semiconductor technology and also develop, design, construct, and sell PV solar power systems that primarily use the modules we manufacture. Additionally, we provide operations and maintenance ("O&M") services to system owners. We have substantial, ongoing research and development efforts focused on module and system level innovations. We are the world's largest thin film PV solar module manufacturer and one of the world's largest PV solar module manufacturers. Our mission is to provide cost-advantaged solar technology through innovation, customer engagement, industry leadership, and operational excellence. First Solar's proven solar solutions diversify the energy portfolio and reduce the risk of fuel-price volatility while delivering a levelized cost of electricity (LCOE) that is cost competitive with fossil fuels today. First Solar has set the benchmark for environmentally responsible product life cycle management by introducing the industry's first global and comprehensive recycling program for solar modules. We are committed to minimizing the environmental impacts and enhancing the social and economic benefits of our products and projects across their life cycle, from raw material sourcing through product end-of-life. For more information about First Solar, please visit www.firstsolar.com First Solar was founded in 1999 and began commercial production in 2002. Since 2002 and through 2018, we have sold over 20 GW of PV solar modules. Assuming average worldwide irradiance and grid electricity emissions, our products are being used to displace approximately 14 million metric tons of CO2e per year during their 25+ year product life. This is equivalent to powering around 10 million average homes, planting 233 million trees and saving 36 billion liters of water (or 14000+ Olympic swimming pools) per year based on worldwide averages.

W0.2

(W0.2) State the start and end date of the year for which you are reporting data.

	Start date	End date
Reporting year	January 1, 2018	December 31, 2018

W0.3

(W0.3) Select the countries/regions for which you will be supplying data.

Germany

Malaysia
United States of America
Viet Nam

W0.4

(W0.4) Select the currency used for all financial information disclosed throughout your response.

USD

W0.5

(W0.5) Select the option that best describes the reporting boundary for companies, entities, or groups for which water impacts on your business are being reported.

Other, please specify

Global manufacturing, recycling and R&D

W0.6

(W0.6) Within this boundary, are there any geographies, facilities, water aspects, or other exclusions from your disclosure?

No

W1. Current state

W1.1

(W1.1) Rate the importance (current and future) of water quality and water quantity to the success of your business.

	Direct use importance rating	Indirect use importance rating	Please explain
Sufficient amounts of good quality freshwater available for use	Vital	Important	Water quality is vital for our operations (direct use) as our thin film solar photovoltaic manufacturing process relies on ultra-pure water production. As we expand our manufacturing footprint, dependency on freshwater availability will increase. The indirect use of water is important as our supply chain relies on sufficient amounts of water to be available for use. However, by switching to less water-intensive electricity generation, this dependence could be reduced. First Solar conducted a lifecycle water assessment of our thin film PV technology which concluded that the life cycle water withdrawal of

			cadmium telluride (CdTe) PV ranges from approximately 382– 425 L/MWh. (Source: Sinha, Meader and de Wild-Scholten, Life Cycle Water Usage in CdTe Photovoltaics, IEEE, Journal of Photovoltaics, 2012) Direct onsite water use represents only ~12% of CdTe PV's lifecycle water withdrawal. The remainder is related to indirect water withdrawal from the use of grid electricity and raw materials throughout the product life cycle. Primary contributors to life cycle water withdrawal in our supply chain include the use of grid electricity, glass, steel and copper production, chemical use, and transport during take-back and recycling.
Sufficient amounts of recycled, brackish and/or produced water available for use	Not very important	Not important at all	Our direct and indirect operations do not depend on having sufficient amounts of brackish or produced water so the "not very important" rating was selected. We have however started recycling water from our routinely operated recycling facilities in order to reduce our water withdrawals. As a result, First Solar's routinely operated recycling facilities in Malaysia, Germany, Vietnam and the U.S. have zero wastewater discharge. This will enable us to operate mobile recycling plants in water scarce regions in the future and in areas where water utilities or wastewater treatment facilities are not available. Our direct and indirect dependency on brackish or produced water availability is unlikely to increase in the future, however recycling water will be increasingly important as our manufacturing footprint and water demand increases. Our supply chain does not rely on recycled, brackish or produced water which is why the "not important at all" rating was selected.

W1.2

(W1.2) Across all your operations, what proportion of the following water aspects are regularly measured and monitored?

	% of sites/facilities/operations	Please explain
Water withdrawals – total volumes	100%	We regularly measure and monitor 100% of our total withdrawals from our manufacturing, recycling, and research and development facilities based on water utility bills. In 2018,

		total water withdrawal across our operations amounted to approximately 3.39 billion liters of water. Our manufacturing facilities in Ohio, Malaysia and Vietnam represent more than 99% (or 3.38 billion liters) of our total water withdrawals .
Water withdrawals – volumes from water stressed areas	Less than 1%	We evaluate the percentage of sites operating in water stressed areas using WWF's Water Risk Filter tool. Less than 1% (or 3 megaliters) of our water withdrawals come from water stressed areas. The WWF Water Risk Filter tool was used to identify locations with high or extremely high baseline water stress (i.e. equal to/greater than 'High': 40-80%).
Water withdrawals – volumes by source	100%	We regularly monitor and measure 100% of the total water withdrawals of our manufacturing, recycling, and research and development facilities based on water utility bills. All withdrawals come from the local municipal supplier (third-party/ freshwater).
Water withdrawals quality	100%	We regularly monitor and measure 100% of our water discharge quality by standard effluent parameters as well as for heavy metals. First Solar factories are equipped with state-of-the-art analytical capabilities for in-house wastewater testing.
Water discharges – total volumes	100%	We regularly monitor and measure 100% of the water discharges of our manufacturing, recycling, and research and development facilities. In 2018, total water discharges from our manufacturing, recycling, and research and development facilities amounted to approximately 1,494 megaliters. Our manufacturing facilities in Ohio, Malaysia and Vietnam represent 99.8% (~1,492 megaliters in 2018) of our total water discharges.
Water discharges – volumes by destination	100%	We regularly monitor and measure 100% of the water discharges by destination of our manufacturing, recycling, and research and development facilities. In 2018, approximately 44% (or 1,494 megaliters) of First Solar's total water withdrawn from water utilities (3,390 megaliters) was discharged as wastewater from our industrial wastewater treatment systems. Approximately 18% or ~274 megaliters was sent

		to a third-party (municipal wastewater facility) and approximately 82% or ~1,220 megaliters is discharged directly to fresh surface water (river).
Water discharges – volumes by treatment method	100%	We regularly monitor and measure 100% of our total water discharge volumes by treatment method. In 2018, we treated ~1492 megaliters of industrial wastewater at our manufacturing facilities in Ohio, Malaysia and Vietnam using a batch discharge system. Our facilities in Ohio, Malaysia and Vietnam represent more than 99% of our total water discharges. Once treated, the water is collected in holding tanks, which are sampled and tested to confirm compliance with regulatory limits before being discharged. No industrial wastewater leaves our site unless we have tested and approved it for discharge, even if it is being discharged to a municipal wastewater treatment plant. If the water contaminant levels are above the permitted discharge limit, it is sent for re-treatment internally. The remaining 1% of our discharged wastewater from our non-manufacturing sites is treated by the municipal wastewater treatment plant.
Water discharge quality – by standard effluent parameters	100%	We regularly monitor and measure 100% of our water discharge quality by standard effluent parameters as well as for heavy metals from our manufacturing sites which represent 99.8% of our total wastewater discharge. First Solar factories are equipped with state-of-the-art analytical capabilities for in-house wastewater testing.
Water discharge quality – temperature	Not relevant	We do not have any high temperature inducing processes in wastewater. This is not anticipated to change or be relevant in the future.
Water consumption – total volume	100%	Approximately 56% of our total water withdrawals (~1.9 billion liters) is consumed during operation and used for irrigation, cooling towers, sanitary purposes, or recycled. We are able to estimate water consumption by subtracting total water discharges from total water withdrawals: 3.4 billion liters-1.5 billion liters= 1.9 billion liters consumed.

Water recycled/reused	100%	We measure the amount of water recycled at our manufacturing and recycling facilities in Malaysia, Ohio, Vietnam and Germany. In 2018, we recycled more than 129 megaliters (or 4% of our total water withdrawals) across our operations.
The provision of fully-functioning, safely managed WASH services to all workers	100%	100% of our facilities provide fully functioning, safely managed WASH services to all workers. Our total water withdrawal data includes sanitary water use at our manufacturing and recycling facilities.

W1.2b

(W1.2b) What are the total volumes of water withdrawn, discharged, and consumed across all your operations, and how do these volumes compare to the previous reporting year?

	Volume (megaliters/year)	Comparison with previous reporting year	Please explain
Total withdrawals	3,389.71	Much higher	Our total water withdrawals were 20% higher in 2018 (approximately 3,390 megaliters) compared to 2017 (2,825 megaliters). Our threshold for "much higher" is defined as any increase of 20% or more. During 2018, we commenced commercial production of Series 6 modules at our manufacturing facilities in Perrysburg, Ohio; Kulim, Malaysia; and Ho Chi Minh City, Vietnam. We produced 2.7 GW DC of solar modules in 2018, which represented an 18% increase from 2017. In addition to the increase in production, we commenced construction on a new manufacturing facility in Vietnam which further contributed to the increase. We expect absolute water withdrawals to increase as we continue to ramp up our manufacturing capacity.
Total discharges	1,494.42	About the same	Our total water discharges remained about the same and increased 1% in 2018 to 1494 megaliters, compared to 1484 megaliters in 2017. Although production increased 18% in 2018, total water discharges only increased by 1%. By recycling rejected water from our purification system back into our raw water tank in Malaysia, we were able to reduce our water

			discharges. In addition, as of January 2018 all routinely-operated First Solar recycling facilities in the U.S., Germany, Vietnam and Malaysia generate zero wastewater discharge. Although, we expect total water discharges to increase in the future as we continue to ramp up our manufacturing capacity, we are managing these impacts by recycling water and operating recycling facilities with zero wastewater discharge.
Total consumption	1,895.29	Much higher	Our total water consumption in 2018 (1,895 megaliters) was approximately 41% higher compared to 2017 (1,341 megaliters). The increase was due to the ramp up in production, which increased by 18% in 2018. In addition, all routinely-operated First Solar recycling facilities in the U.S., Germany, and Malaysia, generate zero wastewater discharge since January 2018. Instead, the wastewater is recycled and converted into freshwater, which can then be reused in the recycling process. As part of the retrofit, we recycled more than 11 million liters of water in 2018 at our global recycling facilities. We are able to estimate water consumption by subtracting total water discharges from total water withdrawals: 3,389.71-1,494.42= 1,895.29 megaliters consumed. We expect our water consumption to increase as we continue to ramp up Series 6 manufacturing and recycle/reuse more water in 2019. To manage our operational impacts, we have been incorporating water efficiency measures into new buildings and tool designs.

W1.2d

(W1.2d) Provide the proportion of your total withdrawals sourced from water stressed areas.

	% withdrawn from stressed areas	Comparison with previous reporting year	Identification tool	Please explain

Row 1	0.1	About the same	WWF Water Risk Filter	Less than 1% of our water withdrawals came from water stressed areas in 2017 and 2018. In 2017, we used the WBCSD water tool and used a different definition for water stress (i.e. areas with less than 1,700 m3/person/yr). Since the WBCSD tool is being retired in 2019, we switched to the WWF Risk Filter Tool and defined stressed areas as having baseline water stress that is equal to/greater than 'High': 40-80%). We evaluate the percentage of sites operating in water stressed areas based on the baseline water stress of our site locations.

W1.2h

(W1.2h) Provide total water withdrawal data by source.

	Relevance	Volume (megaliters/year)	Comparison with previous reporting year	Please explain
Fresh surface water, including rainwater, water from wetlands, rivers, and lakes	Not relevant			Not relevant. All withdrawals come from local municipal suppliers (third-party/freshwater). No change from last year. No changes are expected in the future.
Brackish surface water/Seawater	Not relevant			Not relevant. All withdrawals come from local municipal suppliers (third-party/freshwater). No change from last year.No changes are expected in the future.
Groundwater – renewable	Not relevant			Not relevant. All withdrawals come from local municipal suppliers (third-party/freshwater). No change from last year. No changes are expected in the future.
Groundwater – non-renewable	Not relevant			Not relevant. All withdrawals come from local municipal suppliers (third-party/freshwater). No change

				from last year. No changes are expected in the future.
Produced/Entrained water	Not relevant			Not relevant. All withdrawals come from local municipal suppliers (third-party/freshwater). No change from last year. No changes are expected in the future.
Third party sources	Relevant	3,389.71	Much higher	All withdrawals for our manufacturing, recycling and research and development sites come from local municipal suppliers (third-party/freshwater). Our total water withdrawals were 20% higher in 2018 (3,389 megaliters) compared to 2017 (2,825 megaliters) due to the 18% increase in production capacity and the start-up of new manufacturing facilities. . Total water withdrawals from third party sources are expected to increase in 2019 as we ramp up our Series 6 manufacturing lines.

W1.2i

(W1.2i) Provide total water discharge data by destination.

	Relevance	Volume (megaliters/year)	Comparison with previous reporting year	Please explain
Fresh surface water	Relevant	1,220.08	Lower	On-site treated industrial wastewater at our Malaysia facility is directly discharged to river. Direct wastewater discharge decreased 13% in 2018 (1,220 megaliters)compared to 2017 (1,407 megaliters) due to increased water recycling

				initiatives. Although production increased by 7% at our manufacturing facility in Malaysia, wastewater discharges decreased by 13%. Our threshold for "lower" is defined as any decrease of less than 20%.
Brackish surface water/seawater	Not relevant			On-site treated industrial wastewater is either indirectly discharged to sanitary sewer in the United States, Vietnam and in Germany, or directly discharged to river in Malaysia. Our operations do not discharge wastewater to brackish surface water or seawater. No change from 2017 and no change expected in the future.
Groundwater	Not relevant			On-site treated industrial wastewater is either indirectly discharged to sanitary sewer in the United States and in Germany, or directly discharged to river in Malaysia. Our operations do not discharge wastewater to brackish surface water or seawater. No change from 2017 and no change expected in the future.
Third-party destinations	Relevant	274.34	Much higher	On-site treated industrial wastewater in the U.S., Vietnam and in Germany is indirectly discharged to sanitary sewer. Indirect wastewater discharge increased 254% in 2018 (274 megaliters) compared to 77.6 megaliters in 2017. The increase was largely due to the ramp up of production in Ohio and the start of production at our new manufacturing site in Vietnam. We expect future wastewater discharges to increase as we continue to ramp up production. To

				minimize operational impacts, we have been incorporating efficiency measures into new buildings and tool designs as well as retrofitting our wastewater treatment plants. Our threshold for "much higher" is defined as any increase of 20% or more.

W1.2j

(W1.2j) What proportion of your total water use do you recycle or reuse?

	% recycled and reused	Comparison with previous reporting year	Please explain
Row 1	1-10	About the same	In total, we recycled more than 129 megaliters of water in 2018, which is equivalent to nearly 52 Olympic-sized swimming pools or 4% of our total water use. In 2017, we recycled 79 megaliters which represented 3% of our total water withdrawals. Although the volume of water recycled in 2018 was high than in 2017, the % of water recycled in 2018 was about the same as in 2017. We calculated the % of water recycled and reused using the following equation: volume of water recycled /volume of total water withdrawals *100. We anticipate that the future % of recycled and reused water will increase as we ramp up production and recycling efforts.

W1.4

(W1.4) Do you engage with your value chain on water-related issues?

Yes, our suppliers

Yes, our customers or other value chain partners

W1.4a

(W1.4a) What proportion of suppliers do you request to report on their water use, risks and/or management information and what proportion of your procurement spend does this represent?

Row 1

% of suppliers by number

1-25%

% of total procurement spend

1-25

Rationale for this coverage

First Solar evaluates new suppliers using a balanced scorecard which focuses on the areas of Quality, Cost, Flexibility, Service, Technology and Sustainability. The EHS section of our supplier audit tool uses the Responsible Business Alliance (formerly the EICC) Code of Conduct as a framework and includes questions on water use and water reduction targets. We prioritize engagement by focusing on our module and system component suppliers. Suppliers with a potential of being high risk based on California's Transparency in Supply Chains Act (SB 657) were prioritized for assessment in 2018. We assessed ~8% of suppliers in 2018, representing 16% of our spend. We expect the proportion of suppliers engaged and the % of procurement spend they represent to increase as we continue to roll out our supplier audit tool. Before any materials are used in our manufacturing process, a supplier must undergo a rigorous qualification process.

Impact of the engagement and measures of success

Suppliers are scored in terms of low, medium and high risk to determine whether further engagement or corrective actions are needed. First Solar’s Supplier Quality group trends and monitors on a monthly basis the number of non-conformances and drives the supplier to provide permanent corrective actions to prevent any reoccurrence of issues. After completing an onsite assessment, suppliers are more aware of First Solar's environmental, health and safety (EHS) requirements. Results from audits have led suppliers to make improvements such as creating or improving recycling programs, EHS objectives and targets. The audits have also resulted in increased supplier employee EHS awareness, improved EHS labeling and signage in the workplace, as well as better use of personal protective equipment (PPE) for specific tasks. Per the criteria for scoring suppliers for EHS audits, the assessed suppliers scored an average of 88% in 2018.

Comment

W1.4b

(W1.4b) Provide details of any other water-related supplier engagement activity.

Type of engagement

Onboarding & compliance

Details of engagement

Inclusion of water stewardship and risk management in supplier selection mechanism

% of suppliers by number

1-25

% of total procurement spend

1-25

Rationale for the coverage of your engagement

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Comment

W1.4c

(W1.4c) What is your organization’s rationale and strategy for prioritizing engagements with customers or other partners in its value chain?

First Solar engages customers through thought leadership, by generating awareness of the energy-water nexus. Unlike thermal electric power plants and CSP, solar PV does not require any water to generate electricity during operation and is therefore ideally suited to meet the growing energy and water needs of arid, water-limited regions. While energy security and climate change have been important drivers for renewable energy adoption, water security provides an additional driver. Desalination has become a common application of renewable energy in arid regions (e.g. Middle East, Australia). In addition, customers with their own sustainability goals are particularly interested in understanding how much carbon a First Solar PV plant displaces as well as how much water is saved by avoiding the use of grid electricity. Success is measured in terms of customer interest in the environmental attributes of our technology and megawatts (MW) sold.

W2. Business impacts

W2.1

(W2.1) Has your organization experienced any detrimental water-related impacts?

No

W2.2

(W2.2) In the reporting year, was your organization subject to any fines, enforcement orders, and/or other penalties for water-related regulatory violations?

Yes, fines, enforcement orders or other penalties but none that are considered as significant

W2.2a

(W2.2a) Provide the total number and financial value of all water-related fines.

Row 1

Total number of fines

0

Total value of fines

0

% of total facilities/operations associated

17

Number of fines compared to previous reporting year

About the same

Comment

We received a notice of violation related to wastewater discharged from our Ohio facility. The amount was not significant and did not result in any fines or penalties.

W3. Procedures

W3.3

(W3.3) Does your organization undertake a water-related risk assessment?

Yes, water-related risks are assessed

W3.3a

(W3.3a) Select the options that best describe your procedures for identifying and assessing water-related risks.

Direct operations

Coverage

Full

Risk assessment procedure

Water risks are assessed as part of an enterprise risk management framework

Frequency of assessment

Annually

How far into the future are risks considered?

1 to 3 years

Type of tools and methods used

Tools on the market
Enterprise Risk Management
Other

Tools and methods used

WWF-DEG Water Risk Filter
Internal company methods

Comment

First Solar conducts an annual survey to obtain the company leadership's view of enterprise risks and risk trends over a three-year horizon. The WWF Water Risk filter Tool is used to assess the baseline water stress levels of countries where our manufacturing, recycling and Research and Development facilities are located. Water-related project development risks are assessed based on internal company knowledge.

Supply chain

Coverage

Partial

Risk assessment procedure

Other, please specify
Facility risk scorecards

Frequency of assessment

Six-monthly or more frequently

How far into the future are risks considered?

1 to 3 years

Type of tools and methods used

Tools on the market
Other

Tools and methods used

WWF-DEG Water Risk Filter
Internal company methods

Comment

Our facility risk scorecards assess water risks to our manufacturing facilities in the context of operational and/or business continuity on a semi-annual basis. Potential asset level water risks include natural disasters, production and utility supply disruption, and the inability to operate wastewater treatment plant or ultra pure water production. The level of coverage selected is prioritized according to a facility or supplier's ability to impact operations and business continuity.

Other stages of the value chain

Coverage

Full

Risk assessment procedure

Water risks are assessed as part of other company-wide risk assessment system

Frequency of assessment

Not defined

How far into the future are risks considered?

Up to 1 year

Type of tools and methods used

International methodologies

Tools and methods used

Life Cycle Assessment

Comment

A life cycle assessment was conducted to determine the amount of water consumed across the life cycle of First Solar PV modules and systems. Approximately half the life cycle water withdrawal of First Solar's CdTe PV technology is associated with module manufacturing, one-third with the balance of system, and the remainder with end-of-life recycling, with direct onsite water use representing only ~12% of CdTe PV's life cycle water withdrawal.

W3.3b

(W3.3b) Which of the following contextual issues are considered in your organization's water-related risk assessments?

	Relevance & inclusion	Please explain
Water availability at a basin/catchment level	Relevant, always included	Sufficient water availability is taken into account when siting new manufacturing facilities as our manufacturing process relies on ultrapure water production. Our manufacturing risk scorecards assess potential risks to water availability at our current manufacturing sites. The WWF water risk filter tool is used to assess water stress levels of countries where our manufacturing, recycling and Research and Development

		facilities are located. The assessment determined that less than 1% of our manufacturing, research and development, and recycling sites are located in water stressed areas, defined as water stress of greater than 40% ("High": 40%-80%). In addition to evaluating manufacturing sites, securing sufficient water access for the construction of our utility-scale solar PV power plants is incorporated into our permitting and project development process.
Water quality at a basin/catchment level	Relevant, always included	Sufficient water quality is taken into account when siting new manufacturing facilities as our manufacturing process relies on ultrapure water production. Our manufacturing risk scorecards assess potential risks to water availability and ultrapure water production at our current manufacturing sites.
Stakeholder conflicts concerning water resources at a basin/catchment level	Relevant, always included	Securing sufficient water access for the construction of our utility-scale solar PV power plants is incorporated into our project development process. Each First Solar project begins with an extensive review of potential site locations, and considers the available solar resources, proximity to existing electrical transmission lines, current land uses, site characteristics and environmental sensitivities. Stakeholder engagement is an integral part of First Solar's project development and community outreach activities. First Solar consults with neighbors, community groups, educational institutions, environmental groups, tribal representatives and business organizations to address local concerns and ensure the environmentally responsible design of our solar projects. Water-related project development risks are then assessed based on internal company knowledge.
Implications of water on your key commodities/raw materials	Relevant, always included	First Solar conducted a life cycle assessment to understand the water impacts of our commodities and raw materials. The major contributors to our life cycle water withdrawal include grid electricity, glass, steel, copper, and inverters. Our manufacturing risk scorecards assess potential risks to water availability at our current manufacturing sites. Key raw materials not available for production are evaluated but are considered low risk.
Water-related regulatory frameworks	Relevant, always included	Water-related regulatory frameworks are included in our enterprise risk management process. We are subject to various national, state, local, and international laws and regulations relating to the protection of the environment, including those governing the discharge of pollutants into the air and water. Therefore, we could incur substantial costs, including cleanup costs, fines, and civil or criminal sanctions or liabilities under environmental and occupational health and safety laws and regulations or non-compliance with environmental permits

		required for our operations. We believe we are currently in substantial compliance with applicable environmental and occupational health and safety requirements and do not expect to incur material expenditures for environmental and occupational health and safety controls in the foreseeable future. Future developments such as the implementation of new, more stringent laws and regulations, more aggressive enforcement policies, or the discovery of unknown environmental conditions may require expenditures that could have a material adverse effect on our business, financial condition, or results of operations.
Status of ecosystems and habitats	Relevant, always included	The status of ecosystems and habitats are considered during the PV permitting and project development process. Each First Solar project begins with an extensive review of potential site locations, and considers the available solar resources, proximity to existing electrical transmission lines, current land uses, site characteristics and environmental sensitivities. Prior to being allowed admission to a project site, all workers and visitors are required to receive extensive site safety orientation training, which includes environmental and biological training. Although construction projects always involve some disturbance to existing land and wildlife habitats, responsibly developed PV power plants can create new habitats and help protect animal and plant species (https://doi.org/10.1525/cse.2018.001123). Rainy weather at our California Flats project along with proper habitat protection during construction promoted emergence of fairy shrimp, a rare and federally protected endangered species, in certain vernal pools. Water-related project development risks are assessed based on internal company knowledge.
Access to fully-functioning, safely managed WASH services for all employees	Relevant, always included	First Solar provides access to fully-functioning WASH services for all our associates. Hygienic conditions and a safe water supply is a requirement at all First Solar sites. All First Solar facilities monitor and track water use which is incorporated in First Solar's water inventory. Access to reliable utility water supply is included in First Solar's facility risk scorecards.
Other contextual issues, please specify	Not relevant, explanation provided	There are no other relevant contextual issues.

W3.3c

(W3.3c) Which of the following stakeholders are considered in your organization's water-related risk assessments?

	Relevance & inclusion	Please explain
Customers	Relevant, always included	While energy security and climate change have been important drivers for renewable energy adoption, water security provides an additional driver. Desalination has become a common application of renewable energy in arid regions (e.g. Middle East, Australia). The energy-water nexus associated with traditional energy sources is a growing concern among our customers particularly in water-stressed regions. First Solar modules convert sunlight into electricity without the use of water which provides an additional advantage over conventional energy and concentrated solar power. On a life cycle basis, First Solar's thin film modules use up to 400 times less water per MWh than conventional energy and up to 24 times less water than other solar technologies such as mono-crystalline silicon PV. First Solar engages with customers by collaborating on the development of solar PV projects and by raising awareness of the energy-water-nexus in customer discussions.
Employees	Relevant, always included	First Solar provides access to fully-functioning WASH services for all our associates. Hygienic conditions and a safe water supply is a requirement at all First Solar sites. All First Solar facilities monitor and track water use which is incorporated in First Solar's water inventory.
Investors	Relevant, always included	Socially responsible investors are interested in understanding our water risks and management strategy. We engage with investors through various ESG surveys. We disclose water risks in our annual report and CDP Carbon and Water responses. We also provide insight into our water performance in our annual sustainability metrics (http://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/First-Solar-Sustainability-Metrics.ashx?dl=1) and sustainability report (http://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/FirstSolar_SustainabilityReport_Web_2018.ashx?dl=1).
Local communities	Relevant, always included	Securing sufficient water access for the construction of our utility-scale solar PV power plants is incorporated into our permitting and project development process. Each First Solar project begins with an extensive review of potential site locations, and considers the available solar resources, proximity to existing electrical transmission lines, current land uses, site characteristics and environmental sensitivities. Stakeholder engagement is an integral part of First Solar's project development and community outreach activities. First Solar consults with neighbors, community groups, educational institutions, environmental groups, tribal representatives and business organizations to address local concerns and ensure the environmentally responsible design of our solar projects. Throughout construction, First Solar

		provides regular updates to the local communities through project newsletters, websites and town hall meetings or informational sessions.
NGOs	Relevant, always included	Securing sufficient water access for the construction of our utility-scale solar PV power plants is incorporated into our permitting and project development process. Each First Solar project begins with an extensive review of potential site locations, and considers the available solar resources, proximity to existing electrical transmission lines, current land uses, site characteristics and environmental sensitivities. Stakeholder engagement is an integral part of First Solar's project development and community outreach activities. First Solar consults with environmental groups to address local concerns and ensure the environmentally responsible design of our solar projects. We work with experts in a range of disciplines with the aim of minimizing the biological, cultural and visual impacts of our projects.
Other water users at a basin/catchment level	Relevant, always included	Securing sufficient water access for the construction of our utility-scale solar PV power plants is incorporated into our permitting and project development process. Each First Solar project begins with an extensive review of potential site locations, and considers the available solar resources, proximity to existing electrical transmission lines, current land uses, site characteristics and environmental sensitivities. Stakeholder engagement is an integral part of First Solar's project development and community outreach activities. First Solar consults with neighbors, community groups, educational institutions, environmental groups, tribal representatives and business organizations to address local concerns and ensure the environmentally responsible design of our solar projects.
Regulators	Relevant, always included	Regulatory risks are included in our enterprise risk management process. First Solar engages with regulators as part of the project permitting process to ensure sufficient access to water during the construction of a PV power plant. As part of our public outreach activities, First Solar conducts site tours for community members, organizations, elected officials, schools and universities
River basin management authorities	Relevant, always included	First Solar engages with river basin authorities as part of the project permitting process to ensure sufficient access to water during the construction of a PV power plant.
Statutory special interest groups at a local level	Relevant, always included	First Solar engages with special interest groups at the local level as part of the project permitting process to ensure sufficient access to water during the construction of a PV power plant. As part of our public outreach activities, First Solar conducts site tours for community members, organizations, elected officials, schools and universities. Throughout construction, First Solar provides regular updates to the local communities through project newsletters, websites and town hall meetings or informational sessions.

Suppliers	Relevant, always included	We assess our suppliers' awareness of water risks through our supplier audit tool and include questions relating to their water reduction goals and monitoring practices. First Solar performs periodic cross-functional team reviews of our critical suppliers' performance using a balanced scorecard which focuses on the areas of Quality, Cost, Flexibility, Service, Technology and Sustainability. During these business reviews we communicate First Solar's state of the business and work in partnership with our supply base to develop the best course of action for them to support our dynamic needs. First Solar continues to validate supplier quality through periodic audits and weekly meetings with key suppliers. We prioritize our engagement by focusing on our module and system component suppliers.
Water utilities at a local level	Relevant, always included	Disruptions to water supply for our manufacturing facilities are considered in our facility risk assessment scorecards. We engage with local water utilities to support our mitigation activities in the event of water outages.
Other stakeholder, please specify	Not relevant, explanation provided	There are no other relevant stakeholders.

W3.3d

(W3.3d) Describe your organization's process for identifying, assessing, and responding to water-related risks within your direct operations and other stages of your value chain.

First Solar conducts an annual survey to obtain the company leadership's view of enterprise risks and risk trends over a three-year horizon. Functional leaders and risk owners (Director-level and above) are requested on an annual basis to complete the survey which has an 86% response rate. Risk owners may provide updates more frequently if needed. Risks assessed include areas such as regulatory risks, operational risks, reputational risks, market/customer changes, technology risks, supply chain, organizational adaptability, and corporate sustainability. These may include water risks e.g. water scarcity, EHS obligation and liabilities, biodiversity impacts, and disruptions to water quality and supply. The survey input is converted into a heatmap chart depicting each risk's likelihood and impact. The results are reviewed and analyzed by the Executive Leadership Team and the Board's Audit Committee to guide the company's risk mitigation efforts. ERM updates are provided to the Board's Audit Committee at least twice annually.

Our facility risk scorecards assess water risks to our manufacturing facilities in the context of operational and/or business continuity on a semi-annual basis. Potential asset-level water risks include natural disasters, utility supply disruption, and the inability to operate wastewater treatment plant or ultra pure water production. The level of coverage selected is prioritized according to a facility or supplier's ability to impact operations and business continuity. The

WWF Water Risk Filter Tool is used to assess the baseline water stress levels of countries where our manufacturing, recycling and Research and Development facilities are located.

The development and construction of solar energy generation facilities and other energy infrastructure projects involve numerous risks which are outlined in our annual report. These include water risks which vary project by project. During construction, water is typically needed for site preparation and dust suppression. Ensuring access to water during the construction period is incorporated into our project development and permitting process. Water-related project development risks are assessed based on internal company knowledge.

W4. Risks and opportunities

W4.1

(W4.1) Have you identified any inherent water-related risks with the potential to have a substantive financial or strategic impact on your business?

Yes, both in direct operations and the rest of our value chain

W4.1a

(W4.1a) How does your organization define substantive financial or strategic impact on your business?

First Solar has an enterprise risk management process that includes identifying entity-level risks and opportunities via a forward-looking view (a three-year horizon). Risks are assessed based on likelihood and impact and residual risk, (i.e. remaining risk after action and control activities) is addressed to further mitigate risk. For the 2018 annual assessment, our definition for a substantive financial impact is a direct loss or opportunity cost of more than $50 million. Substantive strategic impacts on our business include a major impact on our strategy, major financial overrun, and/or failure to meet our key strategic goals. Our definition of substantive risk applies to both direct operations and our supply chain.

Natural disasters such as floods and disruptions to our utility water supply that affect a plant's ability to produce and perform process development activities are water risks that could generate substantive change to our business. These risks would likely result in us losing some production for a while, until we are able to bring the affected buildings back to production. In this case, substantive risk is defined in terms of its impact on our overall production. Of the 2.7 GW produced in 2018, our manufacturing facility in Ohio represented approximately 13% while operations in Malaysia represented 82% and our operations in Vietnam represented 5%.

In addition to manufacturing thin film solar photovoltaic (PV) modules, First Solar also develops, finances, engineers, constructs, and operates some of the world’s largest PV power plants. The successful development and construction of solar energy generation facilities is contingent upon, securing necessary water rights for project construction and operation, among other things. Water shortages in regions where we develop and construct PV projects could adversely affect, delay and/or render the successful completion of a particular project infeasible.

W4.1b

(W4.1b) What is the total number of facilities exposed to water risks with the potential to have a substantive financial or strategic impact on your business, and what proportion of your company-wide facilities does this represent?

	Total number of facilities exposed to water risk	% company-wide facilities this represents	Comment
Row 1	3	26-50	First Solar's PV modules are currently produced at our facilities in Perrysburg, Ohio; Kulim, Malaysia; and Ho Chi Minh City, Vietnam. These three sites are exposed to water risks with the potential to have a substantive financial impact on our business. First Solar has an additional recycling facility in Germany and two research and development facilities in the U.S. However water risks at these facilities would not pose a substantive financial impact.

W4.1c

(W4.1c) By river basin, what is the number and proportion of facilities exposed to water risks that could have a substantive impact on your business, and what is the potential business impact associated with those facilities?

Country/Region

United States of America

River basin

St. Lawrence

Number of facilities exposed to water risk

1

% company-wide facilities this represents

1-25

% company's total global revenue that could be affected

1-25

Comment

Of the 2.7 GW produced in 2018, our manufacturing facility in Perrysburg represented approximately 13%. Module sales in 2018 amounted to approximately $502 million. Assuming 13% of our 2018 module manufacturing capacity was impacted, the potential financial impact would be approximately $65 million, or 3% of our net sales which amounted to approximately $2.24 billion in 2018.

Country/Region

Malaysia

River basin

Other, please specify

Muda River

Number of facilities exposed to water risk

1

% company-wide facilities this represents

1-25

% company's total global revenue that could be affected

1-25

Comment

Of the 2.7 GW produced in 2018, our manufacturing facility in Malaysia represented approximately 82%. Module sales in 2018 amounted to approximately $502 million. Assuming 82% of our 2018 module manufacturing capacity was impacted, the potential financial impact would be approximately $412 million, or approximately 18% of our net sales which amounted to approximately $2.24 billion in 2018.

Country/Region

Viet Nam

River basin

Saigon

Number of facilities exposed to water risk

1

% company-wide facilities this represents

1-25

% company's total global revenue that could be affected

1-25

Comment

During 2018, we commenced production at our manufacturing facility in Ho Chi Minh City, Vietnam. Of the 2.7 GW produced in 2018, our manufacturing facility in Vietnam represented approximately 5%. Module sales in 2018 amounted to approximately $502 million. Assuming 5% of our 2018 module manufacturing capacity was impacted, the potential financial impact would be approximately $25 million, or approximately 1% of our net sales which amounted to approximately $2.24 billion in 2018.

W4.2

(W4.2) Provide details of identified risks in your direct operations with the potential to have a substantive financial or strategic impact on your business, and your response to those risks.

Country/Region

United States of America

River basin

St. Lawrence

Type of risk

Physical

Primary risk driver

Increased water stress

Primary potential impact

Reduction or disruption in production capacity

Company-specific description

Utility water outages due to increased water stress could disrupt plant operation in Ohio, resulting in decreased output as identified by our facility risk scorecards. Of the 2.7 GW produced in 2018, our manufacturing facility in Perrysburg represented approximately 13%.

Timeframe

1 - 3 years

Magnitude of potential impact

Medium-low

Likelihood

Exceptionally unlikely

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

10,000,000

Potential financial impact figure - minimum (currency)

Potential financial impact figure - maximum (currency)

Explanation of financial impact

Of the 2.7 GW produced in 2018, our manufacturing facility in Perrysburg represented approximately 13%. Module sales in 2018 amounted to approximately $502 million. We would likely lose some production for a while in the event of a water supply outage until we are able to bring the affected buildings back into production. Assuming production was down for 2 months (impacting the equivalent of 2% of our global production volume in 2018), the potential financial impact would be ~$10 million.

Primary response to risk

Secure alternative water supply

Description of response

In the event of a water outage at our utility supplier, a tanker would be needed to transport water to our plant. In the event of a water supply shortage, the City of Toledo is able to produce 75 million gallons per day of excess water supply which is why the likelihood is listed as exceptionally unlikely.

Cost of response

0

Explanation of cost of response

Cost of response are part of our normal plant operational expenditures and would be a one-off cost.

Country/Region

Malaysia

River basin

Other, please specify

Muda River

Type of risk

Physical

Primary risk driver

Increased water stress

Primary potential impact

Reduction or disruption in production capacity

Company-specific description

Utility water outages due to increased water stress could disrupt plant operation in Malaysia, resulting in decreased output as identified by our facility risk scorecards. Of the 2.7 GW produced in 2018, our manufacturing facility in Malaysia represented approximately 82%.

Timeframe

1 - 3 years

Magnitude of potential impact

High

Likelihood

Unlikely

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

70,000,000

Potential financial impact figure - minimum (currency)

Potential financial impact figure - maximum (currency)

Explanation of financial impact

Of the 2.7 GW produced in 2018, our manufacturing facility in Malaysia represented approximately 82%. Module sales in 2018 amounted to approximately $502 million. We would likely lose some production for a while in the event of a water supply outage until we are able to bring the affected buildings back into production. Assuming production was down for 2 months (impacting the equivalent of 14% of our global production volume in 2018), the potential financial impact would be ~$70 million.

Primary response to risk

Secure alternative water supply

Description of response

First Solar has onsite and offsite water storage to mitigate impacts in the event of utility water outages.

Cost of response

0

Explanation of cost of response

Cost of response are incorporated in our normal plant operational expenditures and would be a one-off cost. Estimated timeframe is 1-3 years.

Country/Region

Viet Nam

River basin

Saigon

Type of risk

Physical

Primary risk driver

Flooding

Primary potential impact

Reduction or disruption in production capacity

Company-specific description

Our facility risk scorecards identified flooding at the loading bays of our manufacturing facility in Vietnam as a potential water-related risk that could disrupt our manufacturing operations. Of the 2.7 GW produced in 2018, our manufacturing facility in Vietnam represented approximately 5%.

Timeframe

1 - 3 years

Magnitude of potential impact

Medium

Likelihood

Unlikely

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

4,000,000

Potential financial impact figure - minimum (currency)

Potential financial impact figure - maximum (currency)

Explanation of financial impact

Of the 2.7 GW produced in 2018, our manufacturing facility in Vietnam represented approximately 5%. Module sales in 2018 amounted to approximately $502 million. In the event of flooding at our warehouse's loading bays, we would be unable to receive materials and equipment which in turn could disrupt our manufacturing operations. Production would be disrupted until we could find an alternative location to receive our goods. Assuming production was down for 1 month (impacting less than 1% of our global production volume in 2018), the potential financial impact would be ~$4 million. Since we began production in Vietnam in 2018, the estimated impact number is relatively low. As production increases and our Vietnam site represents a greater proportion of global manufacturing capacity, the impact would be higher which is why we list the magnitude of the potential impact as "medium".

Primary response to risk

Develop flood emergency plans

Description of response

Our risk mitigation activities include identifying alternative receiving locations, enhancing our facility's flood management capabilities with a flood suction and drainage system that would minimize flooding impacts by carrying storm water away from built-up areas.

Cost of response

0

Explanation of cost of response

Cost of response are part of our normal plant operational expenditures and risk mitigation activities are ongoing.

W4.2a

(W4.2a) Provide details of risks identified within your value chain (beyond direct operations) with the potential to have a substantive financial or strategic impact on your business, and your response to those risks.

Country/Region

United States of America

River basin

St. Lawrence

Stage of value chain

Supply chain

Type of risk

Physical

Primary risk driver

Increased water stress

Primary potential impact

Reduction or disruption in production capacity

Company-specific description

A water outage at our utility supplier would disrupt the supply of water to our manufacturing plant in Ohio, as identified by our facility risk scorecards. Of the 2.7 GW produced in 2018, our manufacturing facility in Perrysburg represented approximately 13%.

Timeframe

1 - 3 years

Magnitude of potential financial impact

Medium-low

Likelihood

Exceptionally unlikely

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

10,000

Potential financial impact figure - minimum (currency)

Potential financial impact figure - maximum (currency)

Explanation of financial impact

Of the 2.7 GW produced in 2018, our manufacturing facility in Perrysburg represented ~13%. Module sales in 2018 amounted to ~$502 million. We would likely lose some production for a while in the event of a water supply outage until we are able to bring the affected buildings back into production. Assuming production was down for 2 months (impacting 3% of our global production volume in 2018), the potential financial impact would be ~ $10 million based on 2018 production volumes.

Primary response to risk

Supplier diversification

Description of response

In the event of a water outage at our utility supplier, a tanker would be needed to transport water to our plant. In the event of a water supply shortage, the City of Toledo is able to produce 75 million gallons per day of excess water supply which is why the likelihood is listed as exceptionally unlikely.

Cost of response

0

Explanation of cost of response

Cost of response are part of our normal plant operational expenditures and would be a one-off cost.

Country/Region

Malaysia

River basin

Other, please specify

Muda River

Stage of value chain

Supply chain

Type of risk

Physical

Primary risk driver

Increased water stress

Primary potential impact

Reduction or disruption in production capacity

Company-specific description

A water outage at our utility supplier would disrupt the supply of water to our manufacturing plant in Malaysia, as identified by our facility risk scorecards. Of the 2.7 GW produced in 2018, our manufacturing facility in Malaysia represented approximately 82%.

Timeframe

1 - 3 years

Magnitude of potential financial impact

High

Likelihood

Unlikely

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

70,000,000

Potential financial impact figure - minimum (currency)

Potential financial impact figure - maximum (currency)

Explanation of financial impact

Of the 2.7 GW produced in 2018, our manufacturing facility in Malaysia represented approximately 82%. Module sales in 2018 amounted to approximately $502 million. We would likely lose some production for a while in the event of a natural disaster interrupting our supply. Assuming our production in Malaysia was down for 2 months (impacting approximately 14% of our global production volume in 2018), the potential financial impact would be approximately $70 million based on 2018 production volumes.

Primary response to risk

Supplier diversification

Description of response

First Solar has onsite and offsite water storage to mitigate impacts in the event of utility water outages.

Cost of response

0

Explanation of cost of response

Cost of response are part of our normal plant operational expenditures and would be a one-off cost.

Country/Region

Viet Nam

River basin

Saigon

Stage of value chain

Supply chain

Type of risk

Physical

Primary risk driver

Seasonal supply variability/inter annual variability

Primary potential impact

Reduction or disruption in production capacity

Company-specific description

A water outage at our utility supplier would disrupt the supply of water to our manufacturing plant in Vietnam, as identified by our facility risk scorecards. Of the 2.7 GW produced in 2018, our manufacturing facility in Vietnam represented approximately 5%.

Timeframe

1 - 3 years

Magnitude of potential financial impact

High

Likelihood

Likely

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

4,000,000

Potential financial impact figure - minimum (currency)

Potential financial impact figure - maximum (currency)

Explanation of financial impact

Of the 2.7 GW produced in 2018, our manufacturing facility in Vietnam represented approximately 5%. Module sales in 2018 amounted to approximately $502 million. We would likely lose some production for a while in the event of water supply outage. Production would be disrupted until we could find an alternative water supply. Assuming production was down for 1 month (impacting less than 1% of our global production volume in 2018), the potential financial impact would be ~$4 million. Since we began production in Vietnam in 2018, the estimated impact number is relatively low. As production increases and our Vietnam site represents a greater proportion of global manufacturing capacity, the impact would be higher which is why we list the magnitude of the potential impact as "high".

Primary response to risk

Supplier diversification

Description of response

Our facility in Vietnam has a water storage tank that can supply 8 hours of production. We also identified a second source which can supply water in the event of a water outage. A water outage already occurred in August 2018 and the secondary source supplied the water.

Cost of response

0

Explanation of cost of response

Cost of response are part of our normal plant operational expenditures and would be a one-off cost.

W4.3

(W4.3) Have you identified any water-related opportunities with the potential to have a substantive financial or strategic impact on your business?

Yes, we have identified opportunities, and some/all are being realized

W4.3a

(W4.3a) Provide details of opportunities currently being realized that could have a substantive financial or strategic impact on your business.

Type of opportunity

Efficiency

Primary water-related opportunity

Cost savings

Company-specific description & strategy to realize opportunity

First Solar is reducing water consumption during manufacturing and recycling through the implementation of water conservation and recycling projects. In 2018, we saved over 129 million liters of water by recycling rejected water from our purification system back

into our raw water tank in Malaysia and retrofitting our recycling facilities to recycle and reuse wastewater.

Estimated timeframe for realization

1 to 3 years

Magnitude of potential financial impact

Low

Are you able to provide a potential financial impact figure?

Potential financial impact figure (currency)

Potential financial impact figure – minimum (currency)

Potential financial impact figure – maximum (currency)

Explanation of financial impact

Type of opportunity

Products and services

Primary water-related opportunity

Increased sales of existing products/services

Company-specific description & strategy to realize opportunity

While energy security and climate change have been important drivers for renewable energy adoption, water security provides an additional driver. The energy-water nexus associated with traditional energy sources is a growing concern particularly in water-stressed regions. Unlike thermal electric power plants and CSP, solar PV does not require any water to generate electricity during operation and is therefore ideally suited to meet the growing energy and water needs of arid, water-limited regions. In addition, First Solar's fully integrated thin film solar module manufacturing process requires less energy, water and semiconductor material than conventional crystalline silicon PV's batch manufacturing process. On a life cycle basis, First Solar's thin film modules use up to 400 times less water per MWh than conventional energy and up to 24 times less water than other solar technologies such as mono-crystalline silicon PV. Increased water demand and drought is generating a need for desalinating seawater which presents a new market opportunity for solar PV and First Solar in the Middle East and Australia. While conventional desalination is an energy-intensive process, using PV to power the desalination process can decarbonize the process significantly. At the Greenough River

Solar Farm in Australia, for example, First Solar PV modules are being used to offset the energy requirements of a desalination plant south of Perth.

Estimated timeframe for realization

Current - up to 1 year

Magnitude of potential financial impact

Medium

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

37,000,000

Potential financial impact figure – minimum (currency)

Potential financial impact figure – maximum (currency)

Explanation of financial impact

The total cost of developing the Greenough River solar project was estimated to be approximately A$50m (or approximately $37 million). https://www.power-technology.com/projects/greenough-river-solar-farm-western-australia/

Type of opportunity

Products and services

Primary water-related opportunity

Increased sales of existing products/services

Company-specific description & strategy to realize opportunity

Floatovoltaics or floating solar PV installations are gaining increasing popularity as a solution for installing solar in areas with limited land availability. First Solar modules have been used in floating solar installations for aquaculture and irrigation canals. Customers in Thailand have installed First Solar modules on shrimp farms using their own floating solar designs, and have also installed First Solar modules panels over canals surrounding rice paddies in Thailand and Indochina. Rice has high water requirements so the solar installation serves two purposes: powering the farming operation and reducing evaporative losses.

Estimated timeframe for realization

>6 years

Magnitude of potential financial impact

Low-medium

Are you able to provide a potential financial impact figure?

Yes, an estimated range

Potential financial impact figure (currency)

Potential financial impact figure – minimum (currency)

0

Potential financial impact figure – maximum (currency)

2,700,000,000

Explanation of financial impact

Thailand plans to construct 2.7 GW of floating PV with estimated completion in 2037. With two-thirds of the Earth's surface covered with water, floatovoltaics have the potential to become more widespread. In addition, the cost of leasing water for solar installations is lower than that of land. However, since these installations are still in their early and experimental stages, the potential financial impact is estimated to be low-medium. The global floating solar panel market is expected to reach $2.7 billion by 2025, according to a report by Grand View Research.

W5. Facility-level water accounting

W5.1

(W5.1) For each facility referenced in W4.1c, provide coordinates, total water accounting data and comparisons with the previous reporting year.

Facility reference number

Facility 1

Facility name (optional)

Perrysburg

Country/Region

United States of America

River basin

St. Lawrence

Latitude

41.557058

Longitude

-83.552515

Total water withdrawals at this facility (megaliters/year)

249.08

Comparison of withdrawals with previous reporting year
Much higher

Total water discharges at this facility (megaliters/year)
115.57

Comparison of discharges with previous reporting year
Much higher

Total water consumption at this facility (megaliters/year)
133.51

Comparison of consumption with previous reporting year
Much higher

Please explain
Water withdrawals, discharges and consumption were much higher in 2018 compared to 2017 as our production increased more than 60% due to the ramp up of our Series 6 module technology. Our threshold for "much higher" is defined as any increase of 20% or more. The volumes for our manufacturing facility in Ohio are sourced from direct measurements.

Facility reference number
Facility 2

Facility name (optional)
Kulim

Country/Region
Malaysia

River basin
Other, please specify
Muda River

Latitude
5.428624

Longitude
100.572598

Total water withdrawals at this facility (megaliters/year)
2,608.58

Comparison of withdrawals with previous reporting year
About the same

Total water discharges at this facility (megaliters/year)
1,220.08

Comparison of discharges with previous reporting year

Lower

Total water consumption at this facility (megaliters/year)

1,388.49

Comparison of consumption with previous reporting year

Higher

Please explain

Water withdrawals at our manufacturing facility in Malaysia were about the same (1% lower) compared to 2017. Water discharges decreased by 13% compared to 2017 and water consumption increased as a result by 12%. As of January 2018, our routinely-operated recycling facility in Malaysia generates zero wastewater discharge. Instead, the wastewater is recycled and converted into freshwater, which can then be reused in the recycling process. Our threshold for "lower" or "higher" is defined as any decrease or increase of less than 20%. The volumes for our manufacturing facility in Malaysia are sourced from direct measurements.

Facility reference number

Facility 3

Facility name (optional)

Dong Nam

Country/Region

Viet Nam

River basin

Saigon

Latitude

10.77653

Longitude

106.70098

Total water withdrawals at this facility (megaliters/year)

526.15

Comparison of withdrawals with previous reporting year

This is our first year of measurement

Total water discharges at this facility (megaliters/year)

156.22

Comparison of discharges with previous reporting year

This is our first year of measurement

Total water consumption at this facility (megaliters/year)

369.92

Comparison of consumption with previous reporting year

This is our first year of measurement

Please explain

We began commercial production at our Vietnam manufacturing facility in 2018 so it is our first year of measurement. The volumes for our manufacturing facility in Vietnam are sourced from direct measurements.

W5.1a

(W5.1a) For each facility referenced in W5.1, provide withdrawal data by water source.

Facility reference number

Facility 1

Facility name

Perrysburg

Fresh surface water, including rainwater, water from wetlands, rivers and lakes

0

Brackish surface water/seawater

0

Groundwater - renewable

0

Groundwater - non-renewable

0

Produced/Entrained water

0

Third party sources

249.08

Comment

Water provided by water utility

Facility reference number

Facility 2

Facility name

Kulim

Fresh surface water, including rainwater, water from wetlands, rivers and lakes

0

Brackish surface water/seawater

0

Groundwater - renewable

0

Groundwater - non-renewable

0

Produced/Entrained water

0

Third party sources

2,608.58

Comment

Water provided by water utility

Facility reference number

Facility 3

Facility name

Dong Nam

Fresh surface water, including rainwater, water from wetlands, rivers and lakes

0

Brackish surface water/seawater

0

Groundwater - renewable

0

Groundwater - non-renewable

0

Produced/Entrained water

0

Third party sources

526.15

Comment

Water provided by water utility

W5.1b

(W5.1b) For each facility referenced in W5.1, provide discharge data by destination.

Facility reference number
Facility 1

Facility name
Perrysburg

Fresh surface water
0

Brackish surface water/Seawater
0

Groundwater
0

Third party destinations
115.57

Comment

Facility reference number
Facility 2

Facility name
Kulim

Fresh surface water
1,220.08

Brackish surface water/Seawater
0

Groundwater
0

Third party destinations
0

Comment

Facility reference number
Facility 3

Facility name
Dong Nam

Fresh surface water
0

Brackish surface water/Seawater
0

Groundwater
0

Third party destinations
156.22

Comment

W5.1c

(W5.1c) For each facility referenced in W5.1, provide the proportion of your total water use that is recycled or reused, and give the comparison with the previous reporting year.

Facility reference number
Facility 1

Facility name
Perrysburg

% recycled or reused
Less than 1%

Comparison with previous reporting year
Higher

Please explain
No water was recycled in 2017. In 2018, approximately 3.97 megaliters were recycled (or 0.12% of our total withdrawals. % recycled is calculated based on volume of recycled water/total volume of water withdrawals *100 in accordance with the Global Reporting Initiative standards.

Facility reference number
Facility 2

Facility name

Kulim

% recycled or reused

1-10%

Comparison with previous reporting year

Higher

Please explain

In 2018, we recycled 3.6% of our total water withdrawals at our manufacturing facility in Malaysia, compared to 3% in 2017. % recycled is calculated based on volume of recycled water/total volume of water withdrawals *100 in accordance with the Global Reporting Initiative.

Facility reference number

Facility 3

Facility name

Dong Nam

% recycled or reused

Less than 1%

Comparison with previous reporting year

This is our first year of measurement

Please explain

We began commercial production at our Vietnam manufacturing facility in 2018 so it is our first year of measurement. % recycled is calculated based on volume of recycled water/total volume of water withdrawals *100 in accordance with the Global Reporting Initiative.

W5.1d

(W5.1d) For the facilities referenced in W5.1, what proportion of water accounting data has been externally verified?

Water withdrawals – total volumes

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water withdrawals – volume by source

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water withdrawals – quality

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water discharges – total volumes

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water discharges – volume by destination

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water discharges – volume by treatment method

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water discharge quality – quality by standard effluent parameters

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water discharge quality – temperature

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water consumption – total volume

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

Water recycled/reused

% verified

Not verified

What standard and methodology was used?

Not applicable. We do not plan to verify our data in the coming year.

W6. Governance

W6.1

(W6.1) Does your organization have a water policy?

Yes, we have a documented water policy that is publicly available

W6.1a

(W6.1a) Select the options that best describe the scope and content of your water policy.

	Scope	Content	Please explain
Row 1	Company-wide	Commitment to align with public policy initiatives, such as the SDGs Commitments beyond regulatory compliance	First Solar's environmental, health and safety policy includes a commitment to conserve natural resources which includes water. The policy is publicly available on our website. In addition, First Solar describes its water management approach in our sustainability report including our commitment to integrate water efficiency measures into new buildings and tools, our alignment with

		Commitment to water-related innovation Commitment to water stewardship and/or collective action Recognition of environmental linkages, for example, due to climate change Other, please specify Commitment to conserve natural resources	SDG 6 to ensure access to clean water, our commitment to water-related innovation water-e.g. developing a Manual Dry Brush Trolley that can be used to clean solar modules without water or electricity, recognition of the link between climate change and the energy-water nexus, as well as our commitment to water stewardship by boasting the lowest water footprint of all solar technologies in the industry. See pg. 1, 17, 35, 37, 41-42, 49, 52, 66, and 70 of our sustainability report. Our sustainability report is publicly available on our website. We are in the process of developing a formal water policy statement. 1, 2

[1]First Solar EHS Policy.pdf

[2]FirstSolar_SustainabilityReport_2018.pdf

W6.2

(W6.2) Is there board level oversight of water-related issues within your organization?

Yes

W6.2a

(W6.2a) Identify the position(s) (do not include any names) of the individual(s) on the board with responsibility for water-related issues.

Position of individual	Please explain
Other, please specify Board of Directors Audit Committee	The Audit Committee of the Board of Directors has the highest level of oversight over risk management for the company. The annual enterprise risk assessment process includes identifying risks that would impact the company's achievement of strategic objectives. Thus, the assessment would consider water risks among other environmental aspects as part of the enterprise risk management process.

W6.2b

(W6.2b) Provide further details on the board's oversight of water-related issues.

	Frequency that water-related issues are a scheduled agenda item	Governance mechanisms into which water-related issues are integrated	Please explain
Row 1	Sporadic - as important matters arise	Monitoring implementation and performance	Water risks and other environmental aspects are integrated into the company's enterprise risk management process. Water scarcity and water resource availability are taken into account in the

		Reviewing and guiding risk management policies Reviewing and guiding strategy	decision making process and help guide our strategy as we expand our manufacturing footprint to new countries. Our solar module manufacturing process relies on ultra pure water production so access to water is key to our operations. The results are reviewed and analyzed by the Executive Leadership Team and the Board's Audit Committee to guide the company's risk mitigation efforts. ERM updates are provided to the Board's Audit Committee at least annually or more frequently. Water risks may be included as important matters arise. Although our enterprise risk management process currently considers risks (including water risks) with a time horizon of up to 3 years, we are considering conducting longer term risk assessments.

W6.3

(W6.3) Provide the highest management-level position(s) or committee(s) with responsibility for water-related issues (do not include the names of individuals).

Name of the position(s) and/or committee(s)

Chief Operating Officer (COO)

Responsibility

Both assessing and managing water-related risks and opportunities

Frequency of reporting to the board on water-related issues

As important matters arise

Please explain

Our COO has the highest level of direct responsibility for water risks and other environmental aspects within the company and reports into the CEO. In addition to overseeing operations, our COO has an executive goal to leverage sustainability as a business enabler. First Solar's Chief Sustainability Officer reports into the Chief Operational Officer and is in charge of overseeing the company's global Environmental Health and Safety (EHS), Sustainability and Recycling programs. The Chief Sustainability Officer provides regular sustainability updates to the executive leadership team and the Board. These updates can include water-related issues as important matters arise.

W6.5

(W6.5) Do you engage in activities that could either directly or indirectly influence public policy on water through any of the following?

Yes, direct engagement with policy makers
Yes, trade associations
Yes, other

W6.5a

(W6.5a) What processes do you have in place to ensure that all of your direct and indirect activities seeking to influence policy are consistent with your water policy/water commitments?

Our vision "to lead the world's sustainable energy future" drives every aspect of our business strategy from developing sustainable solar markets, reducing our operational impacts, increasing the efficiency of our products, reducing the levelized cost of solar electricity, and improving the environmental life cycle benefits of our technology. This includes manufacturing thin film PV modules with the lowest water footprint in the industry and contributing to thought leadership on the energy-water nexus and educating policy makers and trade associations on the EHS impacts of PV. Our corporate policies (including the corporate sustainability and EHS policy) provide guidance on our commitment to reducing operational impacts to ensure alignment, from the manufacturing, construction, operation and end-of-life management of our PV products and projects. We foster a culture where EHS is an integral part of our associates' work and require our contractors and suppliers to adhere to our standards and commitments. Any inconsistency is addressed with a corrective action.

First Solar's Government Affairs team is responsible for guiding public policy and works closely with Origination, Project Development, the Sustainability/EHS team, and the Executive Leadership Team to support the development of PV projects in various markets. First Solar engages with regulators as part of the project permitting process to ensure sufficient access to water during the construction of a PV power plant.

W6.6

(W6.6) Did your organization include information about its response to water-related risks in its most recent mainstream financial report?

Yes (you may attach the report - this is optional)

First-Solar-Inc.-2018-Annual-Report-Web-Posting.pdf

See section on Environmental, Health, and Safety Matters and risks related to our systems business.

W7. Business strategy

W7.1

(W7.1) Are water-related issues integrated into any aspects of your long-term strategic business plan, and if so how?

	Are water-related issues integrated?	Long-term time	Please explain

		horizon (years)	
Long-term business objectives	Yes, water-related issues are integrated	5-10	Water-related issues such as water availability and costs are integrated into our long-term business objectives of maintaining low manufacturing costs as well as the lowest environmental footprint in the industry. Access to sufficient water availability and quality is taken into account when siting new manufacturing facilities as our manufacturing process relies on ultra-pure water production and is key to scaling our manufacturing capacity over the next few years. Sufficient access to water is also taken into account in the development of PV projects. Since we often develop solar projects in arid regions, their success is contingent upon securing necessary water rights for project construction and operation, among other things.
Strategy for achieving long-term objectives	Yes, water-related issues are integrated	5-10	Resource conservation and water recycling projects are part of our strategy to manage manufacturing costs and maintain the lowest environmental footprint in the industry. Our engineering, procurement and construction (EPC) and operation and maintenance teams strive to minimize water usage by implementing responsible construction practices and dry module cleaning techniques where possible. Minimizing water use during the construction and operation of PV power plants contributes to the success of a project which directly impacts our balance sheet.
Financial planning	Yes, water-related issues are integrated	5-10	Water-related issues are integrated into our long-term 5-year financial planning process since water indirectly impacts our manufacturing and recycling costs. Our facility and recycling teams include resource efficiency projects, as well as wastewater treatment plant and recycling upgrades into their budget plans.

W7.2

(W7.2) What is the trend in your organization's water-related capital expenditure (CAPEX) and operating expenditure (OPEX) for the reporting year, and the anticipated trend for the next reporting year?

Row 1

Water-related CAPEX (+/- % change)

-60

Anticipated forward trend for CAPEX (+/- % change)

6,204

Water-related OPEX (+/- % change)

37

Anticipated forward trend for OPEX (+/- % change)

10

Please explain

In 2018, we were focused on starting commercial production at our manufacturing site in Vietnam and did not have any capital expenditures as this was new site. As we continue to ramp up production of our Series 6 module technology and expand manufacturing operations in Ohio, our capital expenditures are anticipated to increase significantly. Water OPEX increased in 2018 due to the increase in water withdrawals associated with the ramp up of production and start up of new manufacturing facilities. We anticipate water OPEX to increase by approximately 10% as we continue to ramp up production of our Series 6 module technology in 2019. To manage our operational impacts, we have been recycling and reusing water in our manufacturing and recycling operations and incorporating water efficiency measures into new buildings and tool designs.

W7.3

(W7.3) Does your organization use climate-related scenario analysis to inform its business strategy?

	Use of climate-related scenario analysis	Comment
Row 1	No, but we anticipate doing so within the next two years	We used forward-looking scenario analyses such as the 2°C scenario, when considering the company's new greenhouse gas emissions target. In assessing the feasibility of science-based targets, we used the CSO Carbon Metric with RCP2.6 - a 2°C GHG mitigation scenario developed under IPCC. The scenario was considered over a medium term time horizon of 5 years, consistent with our business planning horizon. We anticipate using climate-related scenario analysis in the future to bolster our water strategy. We currently use the WWF water risk filter tool to assess water stress levels of countries where our manufacturing, recycling and research and development facilities are located. We have also used the WRI Aqueduct tool to project future water basin stress levels for 2020, 2030 and 2040. Although our enterprise risk management process currently considers risks (including water risks) with a time horizon of up to 3 years, we are considering conducting longer term risk assessments.

W7.4

(W7.4) Does your company use an internal price on water?

Row 1

Does your company use an internal price on water?

No, and we do not anticipate doing so within the next two years

Please explain

We do not anticipate setting an internal price on water within the next two years.

W8. Targets

W8.1

(W8.1) Describe your approach to setting and monitoring water-related targets and/or goals.

	Levels for targets and/or goals	Monitoring at corporate level	Approach to setting and monitoring targets and/or goals
Row 1	Business level specific targets and/or goals Site/facility specific targets and/or goals Other, please specify Company-wide goals	Goals are monitored at the corporate level	As part of our company-wide EHS policy, First Solar strives to conserve natural resources, minimize waste, protect biodiversity and native habitats, and prevent pollution from the manufacturing, construction, operation and end-of-life management of our PV products and installations. Water reduction goals are also sometimes set at the site level and business level (e.g. recycling) to encourage resource efficiency and cost savings

W8.1b

(W8.1b) Provide details of your water goal(s) that are monitored at the corporate level and the progress made.

Goal

Other, please specify

Increased resource efficiency

Level

Company-wide

Motivation

Cost savings

Description of goal

As part of our company-wide EHS policy, First Solar strives to conserve natural resources, minimize waste, protect biodiversity and native habitats, and prevent pollution from the manufacturing, construction, operation and end-of-life management of our PV products and installations.

Baseline year

2009

Start year

2017

End year

2018

Progress

Since 2009, First Solar’s manufacturing water intensity (water consumption per watt produced) has decreased by 34% (from 1.9 liters per watt to 1.25 liters per watt) due to significant improvements in module efficiency, manufacturing throughput, and the implementation of water conservation and recycling projects. In 2018, we saved over 118 million liters of water by recycling rejected water from our purification system back into our raw water tank in Malaysia, which is equivalent to 3.5% of our absolute water withdrawals in 2018.

Goal

Other, please specify

Zero wastewater discharge recycling

Level

Business activity

Motivation

Reduced environmental impact

Description of goal

First Solar's recycling team are committed to finding new ways to make our recycling process more efficient and sustainable. In 2017, the team set a goal for First Solar's routinely-operated recycling facilities to have zero wastewater discharge by retrofitting our wastewater treatment plants and installing evaporators.The evaporators not only reduce wastewater treatment costs but also minimize our recycling process’ dependence on freshwater. This will enable the roll-out of mobile PV recycling solutions in areas where water utilities or wastewater treatment facilities are not available. the wastewater is recycled and converted into freshwater, which can then be reused in the recycling process.

Baseline year

2017

Start year

2018

End year

2018

Progress

Since January 2018, all routinely-operated First Solar recycling facilities in the U.S., Germany, and Malaysia, and Vietnam generate zero wastewater discharge. Instead, the wastewater is recycled and converted into freshwater, which can then be reused in the recycling process. As part of the retrofit, we recycled more than 11 million liters of water at our global recycling facilities, which is roughly equivalent to 0.3% of our absolute water withdrawals in 2018.

W9. Linkages and trade-offs

W9.1

(W9.1) Has your organization identified any linkages or tradeoffs between water and other environmental issues in its direct operations and/or other parts of its value chain?

Yes

W9.1a

(W9.1a) Describe the linkages or tradeoffs and the related management policy or action.

Linkage or tradeoff

Linkage

Type of linkage/tradeoff

Other, please specify

energy-water nexus

Description of linkage/tradeoff

Water and energy are inextricably intertwined. Water is required to generate energy, and energy is needed to pump, treat, and transport water. The energy-water nexus associated with traditional energy sources is a growing concern particularly in water-stressed regions. According to the International Energy Agency, the energy sector accounts for 10 percent of global water withdrawals. A 2014 United Nations World Water Development report predicts that electricity generation could account for more than one-third of global water withdrawals by 2035. On a life cycle basis, First Solar's thin film modules use up to 400 times less water per MWh than conventional energy and

up to 24 times less water than other solar technologies such as mono-crystalline silicon PV. Our fully integrated manufacturing process requires less water than conventional crystalline silicon's batch manufacturing process, enabling First Solar thin film modules to have the lowest water footprint in the industry.

Policy or action

Unlike conventional energy generation, renewable energy sources such as solar PV systems do not require fuel processing and associated water inputs to generate electricity and are consequently more resilient to extreme weather events and severe droughts than hydro and thermoelectric power plants. By directly converting sunlight to electricity without water, solar PV has one of the lowest water footprints in the energy sector, using up to 400 times less water than conventional energy technologies. Solar PV systems can improve access to and sustainability of water supply for agriculture and other uses. In 2018, First Solar produced 2.7 GW of PV solar modules. Assuming worldwide average irradiance and grid electricity emissions, we estimate that our 2018 products are being used to displace 1.9 million metric tons CO2e per year and save approximately 4.9 billion liters of water per year for the 25+ year product life. In addition to converting sunlight into electricity without the use of water, First Solar's frameless (S4) and back-frame (S6) modules typically do not require cleaning as dust is periodically removed by wind and rainfall. An exception is for humid, dust-prone climates, which can transform dry dust into clustered and sticky dust. For such conditions, First Solar developed a Manual Dry Brush Trolley that can be used to clean solar modules without water or electricity.

Linkage or tradeoff

Linkage

Type of linkage/tradeoff

Other, please specify

Decarbonizing desalination

Description of linkage/tradeoff

Increased water demand and drought is generating a need for desalinating seawater which presents a new market opportunity for solar PV and First Solar in the Middle East and Australia. Conventional desalination, however, is an energy-intensive process. Saudi Arabia, for example, uses more than 1.5 million barrels of oil per day to power its desalination plants and produce an estimated 3.3 million m3 of desalinated water per day. (Fthenakis et al., New prospects for PV powered water desalination plants: case studies in Saudi Arabia, 2016.) With desalination capacity set to rise sharply in the Middle East and North Africa, the IEA predicts that by 2040 16% of electricity consumption in the Middle East will be related to water supply. Using First Solar PV modules to power desalination plants helps to significantly decarbonize the desalination process.

Policy or action

While conventional desalination is an energy-intensive process, using PV to power the reverse osmosis desalination process can decarbonize the process significantly. Using

PV to power 44% of the reverse osmosis desalination process has the potential to displace 19 billion liters of diesel fuel per year in Saudi Arabia and approximately 320 billion liters per year across the entire Middle East. This would result in carbon emission reductions of 51.5 million metric tons and 832 million metric tons per year, respectively. Since reverse osmosis is used to recycle water, solar PV could feasibly also decarbonize the recycling process. At the Greenough River Solar Farm in Australia, for example, 10MW of First Solar PV modules are being used to offset the energy requirements of a desalination plant south of Perth. The facility displaces an estimated 20,000 tons of CO2 annually.

W10. Verification

W10.1

(W10.1) Do you verify any other water information reported in your CDP disclosure (not already covered by W5.1d)?

No, we do not currently verify any other water information reported in our CDP disclosure

W11. Sign off

W-FI

(W-FI) Use this field to provide any additional information or context that you feel is relevant to your organization's response. Please note that this field is optional and is not scored.

W11.1

(W11.1) Provide details for the person that has signed off (approved) your CDP water response.

	Job title	Corresponding job category
Row 1	Chief Information Officer | Chief Sustainability Officer | SVP Global Technical Services	Chief Sustainability Officer (CSO)

W11.2

(W11.2) Please indicate whether your organization agrees for CDP to transfer your publicly disclosed data on your impact and risk response strategies to the CEO Water Mandate's Water Action Hub [applies only to W2.1a (response to impacts), W4.2 and W4.2a (response to risks)].

Yes

Submit your response

In which language are you submitting your response?

English

Please confirm how your response should be handled by CDP

	Public or Non-Public Submission	I am submitting to
I am submitting my response	Public	Investors

Please confirm below

I have read and accept the applicable Terms