SASB STANDARDS

Now part of IFRS Foundation

Solar Technology & Project Developers

Sustainability Accounting Standard

RENEWABLE RESOURCES & ALTERNATIVE ENERGY SECTOR

Sustainable Industry Classification System® (SICS®) RR-ST

Under Stewardship of the International Sustainability Standards Board

INDUSTRY STANDARD | VERSION 2023-12

IFRS® Sustainability

sasb.org

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ABOUT THE SASB STANDARDS

As of August 2022, the International Sustainability Standards Board (ISSB) of the IFRS Foundation assumed responsibility for the SASB Standards. The ISSB has committed to maintain, enhance and evolve the SASB Standards and encourages preparers and investors to continue to use the SASB Standards.

IFRS S1 *General Requirements for Disclosure of Sustainability-related Financial Information* (IFRS S1) requires entities to refer to and consider the applicability of disclosure topics in the SASB Standards when identifying sustainability-related risks and opportunities that could reasonably be expected to affect an entity's prospects. Similarly, IFRS S1 requires entities to refer to and consider the applicability of metrics in the SASB Standards when determining what information to disclose regarding sustainability-related risks and opportunities.

In June 2023, the ISSB amended climate-related topics and metrics in the SASB Standards to align them with the industry-based guidance accompanying IFRS S2 *Climate-related Disclosures*. In December 2023, the ISSB amended the non-climate-related topics and metrics in connection with the International Applicability of SASB Standards project.

Effective Date

This version 2023-12 of the Standard is effective for all entities for annual periods beginning or after January 1, 2025. Early adoption is permitted for all entities.

Table of Contents

INTRODUCTION

Overview of SASB Standards

The SASB Standards are a set of 77 industry-specific sustainability accounting standards ("SASB Standards" or "Industry Standards"), categorised pursuant to the Sustainable Industry Classification System® (SICS®).

SASB Standards include:

1. **Industry descriptions** – which are intended to help entities identify applicable industry guidance by describing the business models, associated activities and other common features that characterise participation in the industry.

2. **Disclosure topics** – which describe specific sustainability-related risks or opportunities associated with the activities conducted by entities within a particular industry.

3. **Metrics** – which accompany disclosure topics and are designed to, either individually or as part of a set, provide useful information regarding an entity's performance for a specific disclosure topic.

4. **Technical protocols** – which provide guidance on definitions, scope, implementation and presentation of associated metrics.

5. **Activity metrics** – which quantify the scale of specific activities or operations by an entity and are intended for use in conjunction with the metrics referred to in point 3 to normalise data and facilitate comparison.

Entities using the SASB Standards as part of their implementation of ISSB Standards should consider the relevant ISSB application guidance.

For entities using the SASB Standards independently from ISSB Standards, the *SASB Standards Application Guidance* establishes guidance applicable to the use of all Industry Standards and is considered part of the Standards. Unless otherwise specified in the technical protocols contained in the Industry Standards, the guidance in the SASB Standards Application Guidance applies to the definitions, scope, implementation, compilation and presentation of the metrics in the Industry Standards.

Historically, the *SASB Conceptual Framework* set out the basic concepts, principles, definitions and objectives that guided the SASB Standards Board in its approach to setting standards for sustainability accounting.

Use of the Standards

SASB Standards are intended to aid entities in disclosing information about sustainability-related risks and opportunities that could reasonably be expected to affect the entity's cash flows, its access to finance or cost of capital over the short, medium or long term. An entity determines which Industry Standard(s) and which disclosure topics are relevant to its business, and which associated metrics to report. In general, an entity should use the SASB Standard specific to its primary industry as identified in SICS® . However, companies with substantial business in multiple SICS® industries should refer to and consider the applicability of the disclosure topics and associated metrics in additional SASB Standards.

The disclosure topics and associated metrics contained in this Standard have been identified as those that are likely to be useful to investors. However, the responsibility for making materiality judgements and determinations rests with the reporting entity.

Industry Description

Solar Technology & Project Developers industry entities manufacture solar energy equipment, including solar photovoltaic (PV) modules, polysilicon feedstock, solar thermal electricity-generation systems, solar inverters and other related components. Entities also may develop, build and manage solar energy projects and offer financing or maintenance services to customers. The industry uses two primary technologies: PV and concentrated solar power (CSP). Within solar PV, two main technologies exist: crystalline silicon-based solar and thin-film solar, which includes panels made using copper indium gallium selenide and cadmium telluride. The primary markets for solar panels are residential, non-residential (commercial and industrial) and utility-scale projects. Entities in the industry operate globally.

SUSTAINABILITY DISCLOSURE TOPICS & METRICS

Table 1. Sustainability Disclosure Topics & Metrics

TOPIC	METRIC	CATEGORY	UNIT OF MEASURE	CODE
Energy Management in Manufacturing	(1) Total energy consumed, (2) percentage grid electricity and (3) percentage renewable	Quantitative	Gigajoules (GJ), Percentage (%)	RR-ST-130a.1
Water Management in Manufacturing	(1) Total water withdrawn, (2) total water consumed; percentage of each in regions with High or Extremely High Baseline Water Stress	Quantitative	Thousand cubic metres (m^3), Percentage (%)	RR-ST-140a.1
	Description of water management risks and discussion of strategies and practices to mitigate those risks	Discussion and Analysis	n/a	RR-ST-140a.2
Hazardous Waste Management	(1) Amount of hazardous waste generated, (2) percentage recycled [1]	Quantitative	Metric tonnes (t), Percentage (%)	RR-ST-150a.1
	(1) Number and aggregate quantity of reportable spills, (2) quantity recovered [2]	Quantitative	Number, Kilogrammes (kg)	RR-ST-150a.2
Ecological Impacts of Project Development	(1) Number and (2) duration of project delays related to ecological impacts	Quantitative	Number, Days	RR-ST-160a.1
	Description of efforts in solar energy system project development to address community and ecological impacts	Discussion and Analysis	n/a	RR-ST-160a.2
Management of Energy Infrastructure Integration & Related Regulations	Description of risks associated with integration of solar energy into existing energy infrastructure and discussion of efforts to manage those risks	Discussion and Analysis	n/a	RR-ST-410a.1
	Description of risks and opportunities associated with energy policy and its effect on the integration of solar energy into existing energy infrastructure	Discussion and Analysis	n/a	RR-ST-410a.2

continued...

[1] Note to **RR-ST-150a.1** – The entity shall disclose the legal or regulatory framework(s) used to define hazardous waste and recycled hazardous waste, and the amounts of waste defined in accordance with each applicable framework.

[2] Note to **RR-ST-150a.2** – The entity shall discuss its long-term activities to remediate spills that occurred in years prior to the reporting period but for which remediation activities are ongoing.

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TOPIC	METRIC	CATEGORY	UNIT OF MEASURE	CODE
Product End-of-life Management	Percentage of products sold that are recyclable or reusable	Quantitative	Percentage (%)	RR-ST-410b.1
	(1) Weight of end-of-life material recovered, (2) percentage recycled	Quantitative	Metric tonnes (t), Percentage (%)	RR-ST-410b.2
	Percentage of products by revenue that contain IEC 62474 declarable substances, arsenic compounds, antimony compounds, or beryllium compounds [3]	Quantitative	Percentage (%)	RR-ST-410b.3
	Description of approach and strategies to design products for high-value recycling	Discussion and Analysis	n/a	RR-ST-410b.4
Materials Sourcing	Description of the management of risks associated with the use of critical materials	Discussion and Analysis	n/a	RR-ST-440a.1
	Description of the management of environmental risks associated with the polysilicon supply chain	Discussion and Analysis	n/a	RR-ST-440a.2

Table 2. Activity Metrics

ACTIVITY METRIC	CATEGORY	UNIT OF MEASURE	CODE
Total capacity of photovoltaic (PV) solar modules produced	Quantitative	Megawatts (MW)	RR-ST-000.A
Total capacity of completed solar energy systems[4]	Quantitative	Megawatts (MW)	RR-ST-000.B
Total project development assets[5]	Quantitative	Presentation currency	RR-ST-000.C

[3] Note to **RR-ST-410b.3** – The disclosure shall include a discussion of approach to managing the use of IEC 62474 declarable substances, arsenic compounds, antimony compounds or beryllium compounds..

[4] Note to **RR-ST-000.B** – Solar energy systems are defined as any system that converts sunlight into electrical energy, including 'photovoltaic (PV) system' and 'solar thermal electric systems'. Completed systems are defined by the entity, consistent with its existing public disclosure of completed systems.

[5] Note to **RR-ST-000.C** – Project development assets are defined by the entity, consistent with its existing public disclosure of project development assets, regardless of terminology used by the entity (for example, 'Project assets', 'Project assets—plants and land', 'Solar Energy Systems Held for Development and Sale'). At a minimum, project development assets include assets associated with solar energy systems under development or fully developed, owned by the entity, and held for sale or intended to be sold to a third party prior to the execution of a definitive sales agreement, and assets that consist primarily of capitalised costs incurred in connection with the development of solar energy systems.

Energy Management in Manufacturing

Topic Summary

Solar panel manufacturing typically uses electrical energy purchased from the grid. Energy can account for a considerable share of the total cost of production. Considering rising energy costs and regulatory uncertainty surrounding the future of fossil-based energy, entities that diversify their energy sources may manage the associated risks and maintain a reliable energy supply more effectively. Entities that minimise energy use through effective energy management may reduce costs and gain a competitive advantage through operational efficiency and competitive pricing of products. Competitively priced products are particularly important given the intense price competition within the solar technology industry.

Metrics

RR-ST-130a.1. (1) Total energy consumed, (2) percentage grid electricity and (3) percentage renewable

1 The entity shall disclose (1) the total amount of energy it consumed as an aggregate figure, in gigajoules (GJ).

1.1 The scope of energy consumption includes energy from all sources, including energy purchased from external sources and energy produced by the entity itself (self-generated). For example, direct fuel usage, purchased electricity, and heating, cooling and steam energy are all included within the scope of energy consumption.

1.2 The scope of energy consumption includes only energy directly consumed by the entity during the reporting period.

1.3 In calculating energy consumption from fuels and biofuels, the entity shall use higher heating values (HHV), also known as gross calorific values (GCV), which are measured directly or taken from the Intergovernmental Panel on Climate Change (IPCC).

2 The entity shall disclose (2) the percentage of energy it consumed that was supplied from grid electricity.

2.1 The percentage shall be calculated as purchased grid electricity consumption divided by total energy consumption.

3 The entity shall disclose (3) the percentage of energy it consumed that was renewable energy.

3.1 Renewable energy is defined as energy from sources that are replenished at a rate greater than or equal to their rate of depletion, such as geothermal, wind, solar, hydro and biomass.

3.2 The percentage shall be calculated as renewable energy consumption divided by total energy consumption.

3.3 The scope of renewable energy includes renewable fuel the entity consumed, renewable energy the entity directly produced and renewable energy the entity purchased, if purchased through a renewable power purchase agreement (PPA) that explicitly includes renewable energy certificates (RECs) or Guarantees of Origin (GOs), a Green-e Energy Certified utility or supplier programme, or other green power products that explicitly include RECs or GOs, or for which Green-e Energy Certified RECs are paired with grid electricity.

3.3.1 For any renewable electricity generated on-site, any RECs and GOs shall be retained (not sold) and retired or cancelled on behalf of the entity for the entity to claim them as renewable energy.

3.3.2 For renewable PPAs and green power products, the agreement shall explicitly include and convey that RECs and GOs be retained or replaced and retired or cancelled on behalf of the entity for the entity to claim them as renewable energy.

3.3.3 The renewable portion of the electricity grid mix that is outside of the control or influence of the entity is excluded from the scope of renewable energy.

3.4 For the purposes of this disclosure, the scope of renewable energy from biomass sources is limited to materials certified to a third-party standard (for example, Forest Stewardship Council, Sustainable Forest Initiative, Programme for the Endorsement of Forest Certification or American Tree Farm System), materials considered eligible sources of supply according to the *Green-e Framework for Renewable Energy Certification, Version 1.0* (2017) or Green-e regional standards, or materials eligible for an applicable jurisdictional renewable portfolio standard.

4 The entity shall apply conversion factors consistently for all data reported under this disclosure, such as the use of HHVs for fuel usage (including biofuels) and conversion of kilowatt hours (kWh) to GJ (for energy data including electricity from solar or wind energy).

Water Management in Manufacturing

Topic Summary

Solar photovoltaic panel manufacturing can be water-intensive, and ultra-pure water is a critical input in some processes. The manufacturing process also may generate wastewater, which must be treated before disposal or reuse, and therefore may result in incremental operating costs and capital expenditures. Furthermore, depending on the location, solar equipment manufacturing facilities may face water scarcity and related cost increases or operational disruptions. Water resource use may generate tension with local water users and associated risks, potentially disrupting manufacturing operations and adversely affecting brand value. To mitigate water supply and treatment risks, entities may adopt various strategies such as recycling process water, improving production techniques to lower water intensity, and improving water treatment systems.

Metrics

RR-ST-140a.1. (1) Total water withdrawn, (2) total water consumed; percentage of each in regions with High or Extremely High Baseline Water Stress

1 The entity shall disclose the amount of water, in thousands of cubic metres, that was withdrawn from all sources.

1.1 Water sources include surface water (including water from wetlands, rivers, lakes, and oceans), groundwater, rainwater collected directly and stored by the entity, and water and wastewater obtained from municipal water supplies, water utilities, or other entities.

2 The entity may disclose portions of its supply by source if, for example, significant portions of withdrawals are from non-freshwater sources.

2.1 Fresh water may be defined according to the local laws and regulations where the entity operates. If no legal definition exists, fresh water shall be considered to be water that has less than 1,000 parts per million of dissolved solids.

2.2 Water obtained from a water utility in compliance with jurisdictional drinking water regulations can be assumed to meet the definition of fresh water.

3 The entity shall disclose the amount of water, in thousands of cubic metres, that was consumed in its operations.

3.1 Water consumption is defined as:

3.1.1 Water that evaporates during withdrawal, use and discharge

3.1.2 Water that is directly or indirectly incorporated into the entity's product or service

3.1.3 Water that does not otherwise return to the same catchment area from which it was withdrawn, such as water returned to another catchment area or the sea.

4 The entity shall analyze all of its operations for water risks and identify activities that withdraw and consume water in locations with High (40–80 percent) or Extremely High (>80 percent) Baseline Water Stress as classified by the World Resources Institute's (WRI) Water Risk Atlas tool, Aqueduct.

5 The entity shall disclose its water withdrawn in locations with High or Extremely High Baseline Water Stress as a percentage of the total water withdrawn.

6 The entity shall disclose its water consumed in locations with High or Extremely High Baseline Water Stress as a percentage of the total water consumed.

RR-ST-140a.2. Description of water management risks and discussion of strategies and practices to mitigate those risks

1 The entity shall describe its water management risks associated with water withdrawals, water consumption and discharge of water or wastewater.

1.1 Risks associated with water withdrawals and water consumption include risks to the availability of adequate, clean water resources, which include:

1.1.1 Environmental constraints—such as operating in water-stressed regions, drought, concerns of aquatic impingement or entrainment, interannual or seasonal variability, and risks from the impact of climate change

1.1.2 Regulatory and financial constraints—such as volatility in water costs, stakeholder perceptions and concerns related to water withdrawals (for example, those from local communities, non-governmental organisations and regulatory agencies), direct competition with and impact from the actions of other users (for example, commercial and municipal users), restrictions to withdrawals because of regulations, and constraints on the entity's ability to obtain and retain water rights or permits

1.2 Risks associated with the discharge of water or wastewater include the ability to obtain rights or permits related to discharges, regulatory compliance related to discharges, restrictions to discharges, the ability to maintain control over the temperature of water discharges, liabilities, reputational risks and increased operating costs because of regulation, stakeholder perceptions and concerns related to water discharges (for example, those from local communities, non-governmental organisations and regulatory agencies).

2 The entity may describe water management risks in the context of:

2.1 How risks may vary by withdrawal source, including surface water (including water from wetlands, rivers, lakes and oceans), groundwater, rainwater collected directly and stored by the entity, and water and wastewater obtained from municipal water supplies, water utilities or other entities; and

2.2 How risks may vary by discharge destinations, including surface water, groundwater or wastewater utilities.

3 The entity may discuss the potential effects that water management risks may have on its operations and the time line over which such risks are expected to manifest.

3.1 Effects include those associated with costs, revenue, liabilities, continuity of operations and reputation.

4 The entity shall discuss its short- and long-term strategies or plans to mitigate water management risks, which include:

4.1 The scope of its strategy, plans, goals or targets, such as how they relate to various business units, geographies or water-consuming operational processes.

4.2 Any water management goals or targets it has prioritised, and an analysis of performance against those goals or targets.

4.2.1 Goals and targets include those associated with reducing water withdrawals, reducing water consumption, reducing water discharges, reducing aquatic impingements, improving the quality of water discharges and regulatory compliance.

4.3 The activities and investments required to achieve the plans, goals or targets, and any risks or limiting factors that might affect achievement of the plans or targets.

4.4 Disclosure of strategies, plans, goals or targets shall be limited to activities that were ongoing (active) or reached completion during the reporting period.

5 For water management targets, the entity shall additionally disclose:

5.1 Whether the target is absolute or intensity-based, and the metric denominator if it is an intensity-based target.

5.2 The time lines for the water management activities, including the start year, the target year and the base year.

5.3 The mechanism(s) for achieving the target, including:

5.3.1 Efficiency efforts, such as the use of water recycling or closed-loop systems;

5.3.2 Product innovations, such as redesigning products or services to require less water;

5.3.3 Process and equipment innovations, such as those that enable the reduction of aquatic impingements or entrainments;

5.3.4 Use of tools and technologies (for example, the World Wildlife Fund Water Risk Filter, the Global Water Tool and Water Footprint Network Footprint Assessment Tool) to analyse water use, risks and opportunities; and

5.3.5 Collaborations or programmes in place with the community or other organisations

5.4 The percentage reduction or improvement from the base year, in which the base year is the first year against which water management targets are evaluated towards the achievement of the target.

6 The entity shall discuss whether its water management practices result in any additional lifecycle impacts or trade-offs in its organisation, including trade-offs in land use, energy production and greenhouse gas (GHG) emissions, and why the entity chose these practices despite lifecycle trade-offs.

Hazardous Waste Management

Topic Summary

Solar panel manufacturing may use hazardous substances that can cause adverse health and environmental impacts if not properly managed. Common thin-film technologies use materials including cadmium, gallium arsenide and copper indium gallium (di)selenide, which require careful handling during manufacturing and disposal. The handling and disposal of hazardous wastes produced during manufacturing may result in increased operating costs, capital expenditures, and in some instances regulatory costs. As such, effective management of hazardous materials, including through reduction, reuse, recycling, and safe storage and disposal, may reduce operating costs and mitigate potential regulatory penalties or reputational damage.

Metrics

RR-ST-150a.1. (1) Amount of hazardous waste generated, (2) percentage recycled

1 The entity shall calculate and disclose (1) the total weight of hazardous waste generated, in metric tonnes.

1.1 Hazardous wastes are defined in accordance with the applicable jurisdictional legal or regulatory frameworks where the waste was generated.

2 The entity shall calculate and disclose (2) the percentage of hazardous waste recycled as the weight of hazardous waste generated that was recycled, divided by the total weight of hazardous waste generated.

2.1 Hazardous waste that is reused, reclaimed or remanufactured shall be considered within the scope of recycled.

2.2 Recycled, reused, reclaimed and remanufactured hazardous waste is defined in accordance with the applicable jurisdictional legal or regulatory frameworks where the waste was generated.

2.3 Materials incinerated, including for energy recovery, shall not be considered within the scope of recycled.

2.3.1 Energy recovery is defined as the use of combustible waste to generate energy through direct incineration, with or without other waste, but with recovery of the heat.

2.3.2 The entity may separately disclose the percentage of hazardous waste generated that was incinerated.

3 The entity may use the United Nations Environmental Programme (UNEP) *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* for the purposes of defining hazardous waste or recycled hazardous waste for operations located in jurisdictions that lack applicable legal or regulatory definitions.

4 The entity shall disclose the frameworks used to define hazardous waste and recycled hazardous waste, and the amounts and percentages defined in accordance with each applicable framework.

RR-ST-150a.2. (1) Number and aggregate quantity of reportable spills, (2) quantity recovered

1 The entity shall disclose (1) the total number and quantity (in kilogrammes) of reportable spills, such that:

1.1 reportable spills are defined as any release of a hazardous substance in an amount equal to or greater than the reportable quantity required to be reported to applicable jurisdictional legal or regulatory authorities;

1.1.1 Hazardous substance is defined as a substance or material that an applicable jurisdictional legal or regulatory authority has determined may pose an unreasonable risk to health, safety and property and has been designated as hazardous in accordance with applicable jurisdictional hazardous materials law.

1.1.2 The scope of hazardous substances includes hazardous materials, hazardous wastes, marine pollutants, elevated temperature materials, and materials designated as hazardous by the applicable jurisdictional legal and regulatory framework(s) applicable within the jurisdiction where the materials are generated.

1.1.3 The entity may use definitions of hazardous waste from the United Nations Environment Programme (UNEP) *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*.

1.2 the number of reportable spills shall include any leaks, emissions, discharges, injections, disposals and abandonment releases over time, counted once at the time identified;

1.3 the aggregate quantity reported shall represent the total quantity of material released to the environment and shall not be reduced by the amount of such hazardous substances that are subsequently recovered, evaporated or otherwise lost; and

1.4 the scope of the disclosure includes all spills across all jurisdictions in which the entity operates.

2 The entity shall disclose (2) the quantity of spills recovered, which is calculated as the weight of spilled hazardous substances (in kilogrammes) removed from the environment through short-term release response activities, excluding:

2.1 quantities recovered during longer-term remediation at spill sites; and

2.2 quantities evaporated, burned or dispersed.

3 The entity may disclose releases to soil and water separately.

3.1 A release that qualifies as a release to both soil and water should be reported as a single release to water, with the quantity of the release properly apportioned to soil and water.

4 The entity may separately report spills that occurred in the past, such as those that resulted from abandoned, legacy or decommissioned operations but that were identified and disclosed during the reporting period.

Note to **RR-ST-150a.2**

1 If applicable, the entity shall discuss its activities to remediate spills that occurred in years prior to the disclosure period but for which remediation activities are ongoing and long term.

2 Relevant activities include land-use controls, site monitoring, site maintenance and continued clean up.

Ecological Impacts of Project Development

Topic Summary

Many large, publicly listed solar technology entities conduct project development, including the evaluation and acquisition of land rights, site permitting, and engagement with stakeholders. Successful development may be contingent on securing environmental permitting approval and permission from local governments and communities. Siting of medium or large solar installations in ecologically sensitive areas, including endangered species habitats, may render environmental permitting more difficult and costly. Project development also may be affected by local land-use laws and community opposition to projects because of their land footprint or concerns over local water resource impacts. These factors may slow or disrupt the development process, possibly resulting in higher costs, lost revenues or project delays. Entities with robust strategies for environmental impact assessment and mitigation may reduce the risk of project delays, increasing the likelihood of timely project completion.

Metrics

RR-ST-160a.1. (1) Number and (2) duration of project delays related to ecological impacts

1 The entity shall disclose (1) the total number and (2) the aggregate duration (in days) of site shutdowns or project delays related to ecological impacts.

2 The scope of project delays includes shutdowns and project delays resulting from applicable jurisdictional environmental legal or regulatory enforcement, including laws and regulations addressing ground- and surface-water contamination; hazardous waste transport, containment or disposal; and protection of endangered species.

3 The scope of environmental regulations may include those promulgated by applicable jurisdictional legal or regulatory authorities.

4 The entity may discuss specific delays, including associated costs, root cause and corrective actions for resolved delay, and status of ongoing delays.

RR-ST-160a.2. Description of efforts in solar energy system project development to address community and ecological impacts

1 The entity shall describe its efforts to address the community and ecological impacts of solar energy system project development and operation, in which:

1.1 Community impacts may include land use, concerns around property valuation impacts, visual aesthetics, safety of human health or property, and noise and congestion resulting from construction activities.

1.2 Ecological impacts may include land use, risk of habitat disruption, water consumption, wildlife fatalities and ecological impacts of construction.

2 The scope of the disclosure shall include all solar energy system projects under development, or under consideration for development, regardless of actual or intended ownership.

3 The scope of the disclosure shall include efforts, activities and strategies related to project siting, project design, engagement of the community and other stakeholders, and engagement with regulatory authorities or other permitting authorities.

4 The entity shall describe its efforts to eliminate or mitigate community risks and address community concerns or describe its efforts to communicate project benefits and expected impacts, which may include:

4.1 the use of social impact assessments (SIA) that evaluate, manage and mitigate risks;

4.2 efforts to engage with stakeholders, build consensus and collaborate with communities;

4.3 efforts to create benefits for communities through projects; and

4.4 new and emerging technologies that the entity expects to incorporate into projects that may reduce impacts.

Management of Energy Infrastructure Integration & Related Regulations

Topic Summary

Entities in the industry have faced challenges in establishing solar energy as a cost-competitive means of energy production and GHG reduction, and they have encountered difficulty in capturing a greater market share of global energy generation. To promote greater adoption of solar, the industry may benefit by preventing systemic disruptions to the existing energy infrastructure and essential energy services. Entities are innovating to overcome the technical challenges of increasing solar integration with the grid. They also are engaging regulatory agencies and policymakers to reduce regulatory barriers to solar energy adoption, many of which are emerging because of concerns regarding increasing overall grid electricity costs and grid disruptions. Solar entities are investing in innovative technologies to reduce hardware and installation costs, and they are pursuing business-model innovation to reduce the cost of capital and facilitate the purchase of solar energy systems. Solar technology entities may improve their competitiveness through deploying one or more of these strategies successfully to ensure their ability to scale over the long term.

Metrics

RR-ST-410a.1. Description of risks associated with integration of solar energy into existing energy infrastructure and discussion of efforts to manage those risks

1 The entity shall describe risks, challenges and barriers surrounding the integration of solar energy into the existing energy infrastructure in terms of its products and services.

1.1 Relevant information to provide may include:

1.1.1 Technological barriers to increased integration of solar energy, such as limited transmission network connectivity, lack of access to high-capacity transmission networks, variability in interconnection standards, and inverter interconnection requirements

1.1.2 Operational barriers to increased integration of solar energy, such as curtailment and challenges associated with the variable nature of solar energy

1.1.3 Customer motivations for seeking increased solar energy integration, such as economic advantages, regulatory compliance, risk mitigation, and public perception or reputational risk

2 The entity shall discuss its strategy and approach to design, development and sales to integrate solar energy into the existing energy infrastructure.

2.1 Relevant strategies and approaches may include:

2.1.1 Technical product design

2.1.2 New product or product components development (for example, smart inverters)

2.1.3 Technical innovation to reduce the cost of solar energy modules or systems

2.1.4 Third-party partnerships and product integrations

2.1.5 Project design (for example, project siting in regions with reduced curtailment risk)

2.1.6 Project risk transfer (for example, power purchase agreements (PPAs) with curtailment caps)

2.1.7 Marketing and sales (for example, focus on regions or customer segments with less grid integration risk)

2.1.8 Incorporating energy storage technology or 'smart grid' technology into solar energy systems, whether through proprietary technological development or collaboration with third parties

2.1.9 Products designed to operate 'off-grid' or as part of 'micro-grids'

2.1.10 Innovation that decreases solar energy's levelised cost of energy (LCOE) through the reduction in 'soft costs', including financing, leasing, customer acquisition and development costs

2.1.11 Innovation that increases the total addressable solar energy market

2.2 Relevant information to provide includes:

2.2.1 Whether the entity pursues more than one approach

2.2.2 Whether the entity's approach varies by market

2.2.3 The intensity of R&D requirements for the entity's approach and strategy

2.2.4 The level of competition relative to the entity's approach and strategy

2.2.5 How the entity evaluates the success of its approach

3 The scope of disclosure shall include all the entity's solar energy-related products, product components, projects, project development efforts and services, as well as the associated marketing and sales strategies, in the markets in which the entity operates.

4 The entity may describe how energy infrastructure influences the establishment of sales targets, strategies for specific product categories, technologies or marketing practices in specific regions, research and development (R&D) objectives, and partnerships.

RR-ST-410a.2. Description of risks and opportunities associated with energy policy and its effect on the integration of solar energy into existing energy infrastructure

1 The entity shall discuss the risks and opportunities associated with energy policy and the effect energy policy has on solar energy integration into existing energy infrastructure, in which:

1.1 Relevant risks and opportunities may include:

1.1.1 Direct or indirect government subsidization of solar energy

1.1.2 International trade policy disputes and agreements

1.1.3 Public policies that set out minimum requirements for renewable energy generation (for example, renewable portfolio standards)

1.1.4 Public policies that affect the monetisation of solar energy generation, which may include net metering, time-of-use rates, feed-in tariffs, utility fixed fees and renewable energy priority dispatch

1.1.5 Public policies that affect the financing and tax structure of solar energy, which may include investment tax credits, property-assessed clean energy, loan guarantees and depreciation schedules

1.1.6 Public policies pertaining to any external social costs created by distributed solar energy generation

1.1.7 Policies pertaining to electricity transmission, which may include regional transmission planning, interconnected transmission networks, interconnection standards and high-capacity transmission networks

1.1.8 Replacements to ageing energy generation and transmission infrastructure

2 The entity shall identify the risks and opportunities related to legislation, regulation, rule-making and the overall political environment (hereafter referred to collectively as 'regulatory and political environment') regarding energy policy and the integration of solar energy into energy infrastructure.

2.1 The scope shall include existing, emerging and known future risks and opportunities.

2.2 The scope shall include risks and opportunities that may exist at each jurisdictional level, international governmental organisations, and regulatory organisations.

2.2.1 The scope shall include the relevant policies of utilities, rule-makers and regulators.

3 Relevant information to provide includes, but is not limited to, the impact on demand for the entity's solar energy products and services and the impact on business viability related to risks and opportunities associated with energy policy and the impact energy policy has on the integration of solar energy into the existing energy infrastructure.

Product End-of-life Management

Topic Summary

Solar panels may contain hazardous substances as well as reusable materials of high economic value. Given the rapid expansion of solar energy globally, increasing volumes of solar panels are expected to reach the end of their useful life in the medium term. In some regions, manufacturers may be required by law to take financial responsibility for their products at the end-of-life stage, including collection and recycling. Product take-back, recycling and disposal may result in higher upfront investments or capital expenditures for entities. However, as more modules reach the end of their useful life and this issue receives more legislative attention, entities may differentiate themselves through offering product take-back and recycling services. This may increase revenues as well as result in lower long-term costs by reusing recovered materials in manufacturing processes.

Metrics

RR-ST-410b.1. Percentage of products sold that are recyclable or reusable

1 The entity shall disclose the percentage of products, by weight, that are reusable or recyclable, in which:

1.1 Reusable is defined as a product or packaging conceived and designed to accomplish, within its lifecycle, a specific number of trips, rotations or uses for the same purpose for which it was conceived, consistent with definitions in ISO 14021 *Environmental labels and declarations—Self-declared environmental claims (Type II environmental labelling).*

1.2 Recyclable is defined as a product or packaging diverted from the waste stream through available processes and programmes and can be collected, processed and returned to use in the form of raw materials or products, consistent with definitions in ISO 14021.

2 For products or product materials partially made of recyclable or reusable materials, the entity shall classify the portion of the material that is recyclable or reusable based on a calculation (or an estimate, if appropriate) of the weight of each portion.

3 A product or its components shall be considered recyclable or reusable if they meet these criteria regarding the use of environmental marketing claims:

3.1 A product or package can be collected, separated or otherwise recovered from the waste stream through an established recycling programme for reuse or use in manufacturing or assembling another item.

3.2 When recycling facilities are available to a substantial majority (60%) of consumers or communities where the item is sold, the entity may consider the product (or product component) recyclable without a qualification.

3.3 When recycling facilities are available to less than a substantial majority of customers or communities where the product is sold, the entity shall only consider the product (or product components) recyclable if it makes the appropriate qualification to its customers.

3.4 For items partially made of recyclable components, the entity shall only consider those components recyclable if (a) it clearly and prominently qualifies the recyclable claim to avoid deception about which portions are recyclable, and (b) no components significantly limit the ability to disassemble and recycle the product or components of the product (for example, the size, shape or assembly method).

RR-ST-410b.2. (1) Weight of end-of-life material recovered, (2) percentage recycled

1 The entity shall disclose (1) the weight, in metric tonnes, of materials recovered, including those recovered through recycling services, product take-back programmes, refurbishment services and as manufacturing scrap, in which:

1.1 The scope of the disclosure shall include products, materials, manufacturing scrap and parts at the end of their useful life that would have otherwise been discarded as waste or used for energy recovery, but they have instead been collected.

1.2 The scope of the disclosure shall include both materials physically handled by the entity and materials of which the entity does not take physical possession, but for which it has contracted with a third party the task of collection for the express purpose of reuse, recycling or refurbishment.

1.3 The scope of the disclosure excludes products and parts that are under warranty and have been collected for repairs.

2 The entity shall disclose (2) the percentage recycled, which is calculated as the weight of incoming material reused or reclaimed, plus the weight of material recycled or remanufactured (through treatment or processing) by the entity, plus the weight of material sent externally for further recycling, divided by the total weight of incoming recovered material, in which:

2.1 a material is recycled if it is used, reused or reclaimed;

2.2 reclaimed materials are defined as those processed to recover or regenerate a usable product;

2.3 reused materials are defined as those recovered products or components of products used for the same purpose for which they were conceived;

2.4 recycled and remanufactured materials are defined as waste materials reprocessed or treated through production or manufacturing processes and made into a final product or a component for incorporation into a product;

2.5 materials sent for further recycling include those materials transferred to a third party for the express purpose of reuse, recycling or refurbishment;

2.6 the scope of recycled and remanufactured products includes primary recycled materials, co-products (outputs of equal value to primary recycled materials) and by-products (outputs of lesser value than primary recycled materials);

2.7 portions of products and materials discarded in landfills are not considered recycled;

2.8 only the portions of products directly incorporated into new products, co-products or by-products shall be included in the percentage recycled; and

2.9 materials incinerated, including for energy recovery, are not considered reused, recycled or reclaimed.

2.9.1 Energy recovery is defined as the use of combustible waste to generate energy through direct incineration, with or without other waste, but with recovery of the heat.

3 Electronic waste material (e-waste) shall be considered recycled only if the entity can demonstrate that the material was transferred to entities with third-party certification to a standard for e-waste recycling such as the e-Steward® Standard for Responsible Recycling and Reuse of Electronic Equipment or the Responsible Recycling Practices (R2) Standard for Electronic Recyclers.

3.1 The entity shall disclose the standards to which the entities it has transferred e-waste are compliant.

RR-ST-410b.3. Percentage of products by revenue that contain IEC 62474 declarable substances, arsenic compounds, antimony compounds, or beryllium compounds

1 The entity shall disclose the percentage of products, by revenue, sold during the reporting period that contain International Electrotechnical Commission's (IEC) 62474 *Material Declaration Standard* declarable substances, arsenic compounds, antimony compounds or beryllium compounds, divided by total revenue.

1.1 A product contains a declarable substance if, according to IEC 62474, it contains an amount of the substance above the 'reporting threshold', is within the scope of the 'reporting application' identified, and for which the 'reporting requirement' is mandatory, according to IEC 62474.

1.2 The entity shall calculate the percentage as the revenue from products sold that contain declarable substances, arsenic compounds, antimony compounds or beryllium compounds, divided by total revenue from products sold.

2 The scope of the disclosure includes all products, including products from an entity not required to declare, or otherwise make declarations, according to IEC 62474.

Note to **RR-ST-410b.3**

1 The entity shall discuss its approach to managing the use of substances listed as declarable substance groups or declarable substances in IEC 62474, in addition to arsenic compounds, antimony compounds or beryllium compounds, including a discussion of specific operational processes during which use of these substances is considered and a discussion of actions the entity has taken to manage the use of these substances.

2 Relevant management approaches and actions to describe may include:

2.1 Product design criteria for the exclusion of substances (for example, banned substances lists)

2.2 Use of material substitution assessments, materials and parts procurement guidelines, product safety testing, product declarations (for example, material safety data sheets), and product labelling

3 If the entity assesses and manages the impact of known or potentially toxic substances with reference to other regulations, industry norms or accepted chemical lists, it may choose to identify those practices, and it shall describe the degree of overlap with IEC 62474.

RR-ST-410b.4. Description of approach and strategies to design products for high-value recycling

1 The entity shall discuss its approach and strategies to design products for high-value recycling, in which:

1.1 High-value recycling is defined as recovery of 80% or greater of glass and 80% or greater of metals, and 30% or greater of semiconductor materials.

1.2 The scope of the disclosure shall include products, materials and parts at the end of their useful life that otherwise would have been discarded as waste or used for energy recovery but have instead been collected.

1.3 The scope of the disclosure shall include both materials physically handled by the entity and materials of which the entity does not take physical possession, but for which it has contracted with a third party the task of collection for the expressed purpose of reuse, recycling or refurbishment.

2 The entity shall discuss how it includes high-value recycling considerations into product design such as:

2.1 Use of materials easily and commonly recyclable in existing recycling infrastructure.

2.2 Designing products for recovery and reuse (designing products or components that can be easily and cost-effectively recovered and reused in the manufacturing process).

2.3 Proper identification of products and their component materials to facilitate disassembly and recycling.

3 The entity may discuss its participation in extended producer responsibility (EPR) or voluntary initiatives, including:

3.1 whether the entity directly conducts product take-back, recovery and recycling or if the entity supports infrastructure for product recovery and recycling through joint arrangements, partnerships with retailers and others, or by funding research into recycling technologies;

3.2 whether the initiative is voluntary or mandatory; and

3.3 whether relevant performance measures or targets for the initiative such as the total amount of material recovered and the total amount of material recycled are established.

Materials Sourcing

Topic Summary

Solar technology entities typically source numerous materials including polysilicon, metals, glass and electrical components. Entities additionally use specific materials critical to solar panel and module manufacturing. Limited global resources of these critical materials, as well as their concentration in countries that may have relatively limited governance and regulatory structures or may be subject to geopolitical tensions, expose entities to the risk of supply chain disruptions and input-price increases or volatility. Entities may mitigate associated risks by ensuring supply chain transparency, sourcing materials from reliable suppliers or regions that have minimal environmental or social risks and supporting research into alternative inputs.

Metrics

RR-ST-440a.1. Description of the management of risks associated with the use of critical materials

1 The entity shall describe how it manages the risks associated with the use of critical materials in products, including physical limits on availability and access, changes in price, and regulatory and reputational risks, in which:

1.1 a critical material is defined as a material both essential in use and subject to the risk of supply restriction; and

1.2 examples of critical materials may include:

1.2.1 antimony, cobalt, fluorspar, gallium, germanium, graphite, indium, magnesium, niobium, tantalum and tungsten;

1.2.2 platinum group metals (platinum, palladium, iridium, rhodium, ruthenium and osmium); and

1.2.3 rare earth elements, which include yttrium, scandium, lanthanum and the lanthanides (cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium).

2 The entity shall identify the critical materials that present a significant risk to its operations, the type of risks they represent, and the strategies the entity uses to mitigate the risks.

2.1 Relevant strategies may include diversification of suppliers, stockpiling of materials, development or procurement of alternative and substitute materials, and investments in recycling technology for critical materials.

3 All disclosure shall be sufficient such that it is specific to the risks the entity faces, but that disclosure itself would not compromise the entity's ability to maintain confidential information.

3.1 For example, if an entity determines not to identify a specific critical material that presents a significant risk to its operations because of the competitive harm that could result from the disclosure, the entity shall disclose the existence of such risks, the type of risks, and the strategies used to mitigate the risks, but the entity is not required to disclose the relevant critical material.

RR-ST-440a.2. Description of the management of environmental risks associated with the polysilicon supply chain

1 The entity shall describe its approach to managing the environmental risks associated with the polysilicon supply chain, which may include risks of suppliers' noncompliance with environmental regulations and risks associated with suppliers' disposal and handling of manufacturing wastes (including tetrachloride).

2 Relevant strategies to discuss include due diligence practices, supply chain auditing, supply chain engagement, codes of conduct, and partnerships with industry groups or nongovernmental development organisations.

3 The entity shall describe its process for implementing corrective actions in the event of noncompliance with environmental regulations in the supply chain, including the use of alternative suppliers.

4 The entity may identify which materials within the polysilicon supply chain present an environmental risk to operations, which type of risk they represent (for example, regulatory compliance, reputational risk or physical limits on availability and access), and the strategies the entity uses to mitigate the risk.

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