

Ascent Solar Technologies, Inc.
Form 424B2
February 24, 2012
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Filed Pursuant to Rule 424(b)(2)
Registration No. 333-178821
PROSPECTUS SUPPLEMENT
(To the Prospectus Dated February 3, 2012)

Ascent Solar Technologies, Inc.
Up to \$5,000,000
Common Stock

On January 5, 2012, we entered into an At-the-Market Offering Sales Agreement with JonesTrading Institutional Services LLC, or JonesTrading, regarding up to \$5,000,000 of our common stock, \$0.0001 par value per share, offered by a prospectus supplement and an accompanying prospectus (Registration No. 333-156665) dated January 16, 2009 (together, the "Prior Prospectus"). On February 14, 2012, our new registration statement on Form S-3 (Registration No. 333-178821) was declared effective by the Securities and Exchange Commission. This prospectus supplement and the accompanying prospectus dated February 3, 2012 replaces the Prior Prospectus. In accordance with the terms of the sales agreement, we may offer and sell shares of our common stock at any time and from time to time through JonesTrading as our sales agent. Sales of the common stock, if any, will be made at market prices by any method that is deemed to be an "at the market" offering as defined in Rule 415 under the Securities Act of 1933, including sales made directly on the NASDAQ Global Market and any other trading market for the common stock, and sales to or through a market maker other than on an exchange.

The aggregate compensation payable to JonesTrading as sales agent shall be equal to 3% of the gross sales price of the shares sold through JonesTrading pursuant to the sales agreement.

Subject to the terms and conditions of the sales agreement, JonesTrading will use its commercially reasonable efforts to sell on our behalf any shares to be offered by us under the sales agreement. The offering of our common stock pursuant to the sales agreement will terminate upon the earlier of (1) the sale of all the shares of our common stock offered by this prospectus supplement and the accompanying prospectus or (2) the termination of the sales agreement by us or by JonesTrading.

Our common stock is traded on the NASDAQ Global Market under the symbol "ASTI." The last reported sale price of our common stock on February 24, 2012 was \$0.76 per share.

As of January 19, 2012, the aggregate market value of our outstanding voting and non voting common equity held by non-affiliates is \$26.2 million. Within the last 12 months we have not sold any securities pursuant to General Instruction 1.B.6 to Form S-3.

Investing in our common stock involves risks. See "Risk Factors," beginning on page S-3 and the risk factors discussed in our most recent Annual Report on Form 10-K, each subsequently filed quarterly report on Form 10-Q and other information we file from time to time with the Securities and Exchange Commission.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed upon the adequacy or accuracy of this prospectus supplement or the accompanying prospectus. Any representation to the contrary is a criminal offense.

The date of this prospectus supplement is February 24, 2012.

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ABOUT THIS PROSPECTUS SUPPLEMENT

This document is in two parts. The first part is this prospectus supplement, which describes the specific terms of the offering and also adds to and updates information contained in the accompanying prospectus and the documents incorporated by reference into this prospectus supplement and the accompanying prospectus. The second part, the accompanying prospectus dated February 3, 2012, including the documents incorporated by reference, provides more general information. Generally, when we refer to this prospectus, we are referring to both parts of this document combined. To the extent there is a conflict between the information contained in this prospectus supplement, on the one hand, and the information contained in the accompanying prospectus or in any document incorporated by reference that was filed with the Securities and Exchange Commission, or SEC, before the date of this prospectus supplement, on the other hand, you should rely on the information in this prospectus supplement. If any statement in one of these documents is inconsistent with a statement in another document having a later date, the statement in the document having the later date modifies or supersedes the earlier statement. You should read this prospectus supplement and the accompanying prospectus, including the information incorporated by reference and any free writing prospectus that we may provide to you in connection with this offering, in their entirety before making an investment decision.

You should rely only on the information contained or incorporated by reference in this prospectus supplement and the accompanying prospectus, along with the information contained in any free writing prospectus that we may provide to you in connection with this offering. We have not authorized anyone to provide you with different or additional information. You should assume that the information appearing in this prospectus supplement, the accompanying prospectus, the documents incorporated by reference in this prospectus supplement and the accompanying prospectus, and in any free writing prospectus that we may provide to you in connection with this offering is accurate only as of the respective dates of those documents. Our business, financial condition, results of operations and prospects may have changed since those dates.

As used in this prospectus supplement, the terms “Ascent,” “we,” “us” and “our” refer to Ascent Solar Technologies, Inc. PROSPECTUS SUPPLEMENT SUMMARY

The following summary highlights selected information contained elsewhere in this prospectus supplement, the accompanying prospectus and the documents incorporated by reference in this prospectus supplement and the accompanying prospectus. It does not contain all the information you will need in making your investment decision. You should carefully read this entire prospectus supplement, the accompanying prospectus and the documents that they incorporate by reference. You should pay special attention to the “Risk Factors” section of this prospectus supplement beginning on page S-3 and our Annual Report on Form 10-K for the year ended December 31, 2010 and each subsequently filed annual report on Form 10-K and quarterly report on Form 10-Q.

OUR BUSINESS

Overview

We are a development stage company formed in October 2005 to commercialize flexible photovoltaic (“PV”) modules using proprietary technology. Our technology was initially developed at ITN Energy Systems, Inc. (“ITN”) by our founder and core scientific team beginning in 1994 and subsequently assigned and licensed to us. Our proprietary manufacturing process deposits multiple layers of materials, including a thin film of highly efficient copper-indium-gallium-diselenide (“CIGS”) semiconductor material, on a flexible, lightweight, plastic substrate and then laser patterns the layers to create interconnected PV cells, or PV modules, in a process known as monolithic integration. We believe that our technology and manufacturing process provide us with significant advantages over both the crystalline silicon based PV manufacturers that currently dominate the PV market, as well as other thin-film PV manufacturers that use rigid and/or heavier substrate materials such as glass, stainless steel or other metals. Our target markets include the building integrated PV (“BIPV”) market, the building applied PV (“BAPV”) market, the electronic integrated PV (“EIPV”) market, the military and governmental portable power markets and the space and near-space markets.

We completed construction of our FAB1 production line in December 2007. In 2008 we began placing purchase orders for equipment to be installed in our second production facility (“FAB2”) and purchased an existing building in Thornton, Colorado. During 2008 and early 2009, the building was renovated to accommodate our manufacturing

requirements. In 2009, we began receiving production equipment in FAB2 and started qualification of the equipment. Throughout 2010, we continued qualification of the equipment in FAB2 and began production of PV modules. Currently we are in limited production utilizing a combination of equipment from our FAB1 and FAB2 production lines. We are qualifying equipment that has been delivered and additional equipment is scheduled for delivery in 2012 and we have adjusted our utilization of equipment based on our near term forecast. Under our current business plan, we expect losses to

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continue until annual production reaches approximately 30 MW or more. We intend to augment our own manufacturing capabilities by licensing our proprietary manufacturing processes to others. We plan to continue manufacturing at our current facilities; however, our plans are to have significant future production capacity enabled through partnerships, joint ventures or other commercial or licensing arrangements. To date, we have financed our operations primarily through public and private equity financings.

On August 12, 2011, we entered into an investment and strategic alliance with TFG Radiant Investment Group Ltd. and its affiliates ("TFG Radiant"), pursuant to which TFG Radiant made an initial \$7.36 million equity investment in us, and, in connection with such investment, received an option to acquire an additional 9,500,000 shares our common stock at an exercise price of \$1.55 per share.

In addition, in exchange for the grant by the Company of exclusive rights to manufacture and sell solar devices based on the Company's proprietary CIGS PV technology in East Asia (comprised of China, Taiwan, Hong Kong, Thailand, Malaysia, Indonesia, Korea and Singapore), TFG Radiant has committed to invest \$165 million to build an initial FAB in East Asia using the Company's proprietary processes for manufacturing flexible CIGS PV, will provide consulting fees to the Company in connection with installation and commissioning of any FABs in East Asia, will provide license fees, royalty payments, and ownership interest in all East Asia FABs, and subject to the East Asia FABs meeting certain milestones related to production and costs, will provide over time incentive payments to the Company of up to \$250 million.

On December 30, 2011, TFG Radiant agreed to purchase 8,067,390 shares of the Company's common stock presently owned by Norsk Hydro for \$4 million, or approximately \$0.50 per share, This transaction is expected to close during the first quarter of 2012. Upon closing of the transaction TFG Radiant's ownership would increase to approximately 41 percent of the Company's outstanding common stock.

We believe that there remains strong interest in renewable energy in general and solar in particular, but existing global political and financial conditions are significantly disrupting key solar markets. Throughout 2011, there was a reduction in the then-current and expected average selling prices for PV modules. This was a result of many factors, most significantly the increased industry-wide manufacturing capacity, which has contributed to excess industry channel inventories, and a concurrent scaling back of government subsidies and incentives related to solar energy.

As a result of these recent significant adverse changes in market conditions, we concluded that the carrying value of property, plant and equipment might not be recoverable. This analysis utilized projected selling prices and operating costs under alternative scenarios to arrive at total estimated undiscounted cash flows. As a result of the analysis, in the second quarter of 2011 we used discounted cash flows to calculate and record an impairment loss of \$78.0 million in the carrying value of property, plant and equipment and deposits on manufacturing equipment.

We are a development stage company and we have a history of net losses. As of September 30, 2011, we had an accumulated deficit of approximately \$177.4 million, including a net loss of approximately \$100.2 million for the nine months ended September 30, 2011 and a net loss of \$21.5 million for the nine months ended September 30, 2010.

As of December 31, 2011, we had approximately \$23.9 million in cash and investments. As discussed above, we are in the development stage and are currently incurring significant losses from operations as we work toward commercialization. We commenced limited production on our initial production line in the first quarter of 2009 and the second production line in 2010. We do not expect that sales revenue and cash flows from product revenue will be sufficient to support operations and cash requirements until actual full production capacity is achieved. Changes in the level of expected operating losses, the timing of planned capital expenditures or other factors may negatively impact cash flows and reduce current cash and investments faster than anticipated. We expect that we will need to raise additional capital in the future. There is no assurance that we will be able to raise additional capital on acceptable terms or at all.

Corporate Information

We are incorporated under the laws of Delaware. Our principal business office is located at 12300 Grant Street, Thornton, Colorado 80241, and our telephone number is (720) 872-5000. Our website address is www.ascentsolar.com. Information contained on our website or any other website does not constitute part of this prospectus supplement.

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THE OFFERING

Common stock offered	Up to \$5,000,000 of our common stock, par value \$0.0001 per share
Use of proceeds	We intend to use the net proceeds from this offering for general corporate purposes. See “Use of Proceeds” beginning on page S-5 of this prospectus supplement.
NASDAQ Global Market Symbol	“ASTI”
Risk factors	Investing in our common stock involves a high degree of risk. See “Risk Factors” beginning on page S-3 of this prospectus supplement and other information included or incorporated by reference in this prospectus supplement and the accompanying prospectus.

The Company has previously sold approximately \$1.3 million of this Offering under the Prior Prospectus, which leaves approximately \$3.7 million of this Offering available for sale under this prospectus supplement.

RISK FACTORS

Investing in our common stock involves a high degree of risk. Before making an investment in our common stock, you should carefully consider the risk factors set forth below and discussed under the section captioned “Risk Factors” contained in our Annual Report on Form 10-K for the year ended December 31, 2010 and each subsequently filed annual report on Form 10-K and quarterly report on Form 10-Q, which are incorporated by reference in this prospectus supplement and the accompanying prospectus in their entirety, together with the other information contained in this prospectus supplement, the accompanying prospectus and the documents we have incorporated by reference. If one or more of the possibilities described below or in the “Risk Factors” section of our Annual Report on Form 10-K for the year ended December 31, 2010 or Forms 10-K or Forms 10-Q filed thereafter actually occur, our operating results and financial condition would likely suffer and the trading price of our common stock could fall, causing you to lose some or all of your investment in the securities we are offering.

Risks Relating to an Investment in Our Common Stock

The price of our common stock may continue to be volatile.

Our common stock is currently traded on the NASDAQ Global Market. The trading price of our common stock from time to time has fluctuated widely and may be subject to similar volatility in the future. For example, in 2011 our common stock closed as low as \$0.39 and as high as \$3.80, and in 2010, closed as low as \$2.02 and as high as \$6.03. In 2012, our common stock has closed as low as \$0.42 and as high as \$1.06. The trading price of our common stock in the future may be affected by a number of factors, including events described in these “Risk Factors.” In recent years, broad stock market indices, in general, and smaller capitalization and PV companies, in particular, have experienced substantial price fluctuations. In a volatile market, we may experience wide fluctuations in the market price of our common stock. These fluctuations may have a negative effect on the market price of our common stock regardless of our operating performance. In the past, following periods of volatility in the market price of a company’s securities, securities class action litigation has often been instituted. A securities class action suit against us could result in substantial costs, potential liabilities and the diversion of management’s attention and resources, and could have a material adverse effect on our financial condition.

Management will have broad discretion as to the use of the proceeds from this offering, and we may not use the proceeds effectively.

Our management will have broad discretion in the application of the net proceeds from this offering and could spend the proceeds in ways that do not improve our results of operations or enhance the value of our common stock. Our failure to apply these funds effectively could have a material adverse effect on our business, delay the production and sale of our PV modules and cause the price of our common stock to decline.

Future sales or the potential for future sales of our securities may cause the trading price of our common stock to decline and could impair our ability to raise capital through subsequent equity offerings.

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Sales of a substantial number of shares of our common stock or other securities in the public markets, or the perception that these sales may occur, could cause the market price of our common stock or other securities to decline and could materially impair our ability to raise capital through the sale of additional securities. A large number of our outstanding shares are not registered under the Securities Act of 1933, as amended. If and when these shares are registered or become eligible for sale to the public market, the market price of our common stock could decline. If you purchase the securities sold in this offering, you may experience dilution if we issue additional equity securities in future fundraising transactions.

If we issue additional common stock, or securities convertible into or exchangeable or exercisable for common stock, our stockholders, including investors who purchase shares in this offering, will experience dilution, and any such issuances may result in downward pressure on the price of our common stock.

Some provisions of our charter documents and Delaware law may have anti-takeover effects that could discourage an acquisition of us by others, even if an acquisition would be beneficial to our stockholders, and may prevent attempts by our stockholders to replace or remove our current management.

Provisions in our Certificate of Incorporation and Bylaws, as well as provisions of Delaware law, could make it more difficult for a third party to acquire us, or for a change in the composition of our Board of Directors (our "Board") or management to occur, even if doing so would benefit our stockholders. These provisions include:

- authorizing the issuance of "blank check" preferred stock, the terms of which may be established and shares of which may be issued without stockholder approval;

- dividing our Board into three classes;

- limiting the removal of directors by the stockholders; and

- limiting the ability of stockholders to call a special meeting of stockholders.

In addition, we are subject to Section 203 of the Delaware General Corporation Law, which generally prohibits a Delaware corporation from engaging in any of a broad range of business combinations with an interested stockholder for a period of three years following the date on which the stockholder became an interested stockholder, unless such transactions are approved by our Board. This provision could have the effect of delaying or preventing a change of control, whether or not it is desired by or beneficial to our stockholders. See "Description of Securities—Anti-Takeover Effects of Certain Provisions of Delaware Law and Our Certificate of Incorporation and Bylaws" in the accompanying prospectus.

Norsk Hydro Produksjon AS ("Norsk Hydro") and TFG Radiant, our two largest stockholders, are exempt from the general prohibitions of Section 203 because the transactions by which they became interested stockholders in March 2007 and August 2011, respectively, were approved by our Board. Because Norsk Hydro and TFG Radiant each have one representative on our Board, it is less likely that a third party could become an interested stockholder without the consent of both Norsk Hydro and TFG Radiant.

On January 4, 2012, we announced that TFG Radiant had agreed to purchase 8,067,390 shares of our common stock presently owned by Norsk Hydro for \$4 million, or approximately \$0.50 per share. This transaction is expected to close during the first quarter of 2012. Upon closing of this transaction, TFG Radiant's ownership would increase to approximately 41 percent of our outstanding common stock. Following such closing, we anticipate that Norsk Hydro's current representative on our board will be replaced with a second representative of TFG Radiant. Furthermore, if at any time in the future TFG Radiant owns forty-five percent (45%) or more of our outstanding common stock, TFG Radiant will be entitled to have a third representative appointed to our board.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus supplement includes "forward-looking statements" that involve risks and uncertainties. Forward-looking statements include statements concerning our plans, objectives, goals, strategies, future events, future net sales or performance, capital expenditures, financing needs, plans or intentions relating to acquisitions, business trends and

other information that is not historical information and, in particular, appear under headings including “Summary” and “Business.” When used in this prospectus supplement, the words “estimates,” “expects,” “anticipates,” “projects,” “plans,” “intends,” “believes,” “forecasts,” “foresees,” “likely,” “may,” “should,” “goal,” “target” and variations of such words or similar expressions are intended to identify forward-looking statements. All forward-looking statements are based upon information available to us on the date of this prospectus supplement.

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These forward-looking statements are subject to risks, uncertainties and other factors, many of which are outside of our control, that could cause actual results to differ materially from the results discussed in the forward-looking statements, including, among other things, the matters discussed in this prospectus supplement in the section captioned “Risk Factors” and in the “Risk Factors” section of our Annual Report on Form 10-K for the year ended December 31, 2010 and Forms 10-K and Forms 10-Q filed thereafter. Factors you should consider that could cause these differences include, but are not limited to:

• Our limited operating history and lack of profitability;

• Our ability to secure equity or debt or other financing necessary to fund our operations and the acquisition of additional operating capacity;

• Our ability to meet the cost and performance metrics and to implement the production capacity that we have forecasted;

• Our ability to develop demand for, and sales of, our photovoltaic modules and establish strategic relationships with key distribution partners, including original equipment manufacturers, system integrators and distributors;

• Our ability to obtain necessary or desired certifications for our photovoltaic modules;

• Whether we receive timely delivery of production tools from our equipment suppliers;

• Our ability to design, purchase, install, qualify and operate production tools pursuant to our business plan and within budgeted amounts;

• The extent to which we are able to reduce the per watt manufacturing costs of our photovoltaic modules, and the extent to which our competitors are able to do the same with their photovoltaic modules;

• Global demand for electricity and the market for renewable energy, including solar energy;

• The cost-effectiveness of photovoltaic-generated energy relative not only to that generated from conventional sources such as fossil fuels, but also to that generated from other renewable sources which include wind, biomass, geothermal and tidal power;

• The availability of, or changes to, government policies, subsidies and incentives that affect the use or cost of renewable energy;

• The emergence of disruptive or competing technologies in the energy industry;

• Our competitive position and that of our photovoltaic modules relative to others in the photovoltaic and thin-film markets;

• The extent to which our interests align with or deviate from that of Norsk Hydro and TFG Radiant, our largest stockholders, and their affiliates;

• Foreign currency exchange fluctuations, political instability in certain foreign markets or the general state of geopolitical affairs;

• The supply and price of equipment, components and raw materials;

•The status of our relationship with ITN Energy Systems, Inc.;

•Our ability to attract and retain key executives and employees;

•Our continued investment in research and development, and our ability to remain competitive through development of new technologies;

•The extent to which we are able to manage the expansion of our operations effectively, both domestically and abroad;

•Commencement of legal proceedings against us or by us, including proceedings relating to environmental matters or intellectual property rights;

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Our ability to expand and protect the intellectual property portfolio that relates to our photovoltaic modules and processes;

The extent to which we qualify to perform research and development under the federal government's Small Business Innovation Research program; and

General economic and business conditions.

There may be other factors that could cause our actual results to differ materially from the results referred to in the forward-looking statements. We undertake no obligation to publicly update or revise forward-looking statements to reflect subsequent events or circumstances after the date made or to reflect the occurrence of unanticipated events, except as required by law.

USE OF PROCEEDS

The amount of proceeds from this offering will depend on the number of shares sold and the market price at which they are sold. We intend to use the net proceeds from this offering for general corporate purposes.

PLAN OF DISTRIBUTION

We have entered into an At-the-Market Offering Sales Agreement, or Sales Agreement, with JonesTrading Institutional Services LLC, or JonesTrading, under which we may issue and sell from time to time up to \$5,000,000 of our common stock through JonesTrading as our sales agent. Sales of the common stock, if any, will be made at market prices by any method that is deemed to be an "at the market" offering as defined in Rule 415 under the Securities Act, including sales made directly on the NASDAQ Global Market and any other trading market for our common stock, and sales to or through a market maker other than on an exchange.

As sales agent, JonesTrading will not engage in any transactions that stabilize our common stock.

JonesTrading will offer the common stock subject to the terms and conditions of the Sales Agreement on a daily basis or as otherwise agreed upon by us and JonesTrading. We will designate the maximum amount of common stock to be sold through JonesTrading on a daily basis or otherwise determine such maximum amount together with JonesTrading. Subject to the terms and conditions of the Sales Agreement, JonesTrading will use its commercially reasonable efforts to sell on our behalf all of the shares of common stock requested to be sold by us. We may instruct JonesTrading not to sell common stock if the sales cannot be effected at or above the price designated by us in any such instruction. We or JonesTrading may suspend the offering of the common stock being made through JonesTrading under the Sales Agreement upon proper notice to the other party.

The aggregate compensation payable to JonesTrading as sales agent shall be equal to 3% of the gross sales price of the shares sold through it pursuant to the Sales Agreement.

The remaining sales proceeds, after deducting any expenses payable by us and any transaction fees imposed by any governmental, regulatory, or self-regulatory organization in connection with the sales, will equal our net proceeds for the sale of such common stock. Pursuant to a requirement of the Financial Industry Regulatory Authority, or FINRA, the maximum commission or discount to be received by any FINRA member or independent broker/dealer may not be greater than 8% of the gross proceeds received by the offeror for the sale of any securities being registered pursuant to SEC Rule 415 under the Securities Act of 1933, as amended.

JonesTrading will provide written confirmation to us following the close of trading on the NASDAQ Global Market as applicable, each day in which common stock is sold through it as sales agent under the Sales Agreement. Each confirmation will include the number of shares of common stock sold through it as sales agent on that day, the gross sales price per share, the net proceeds to us and the compensation payable by us to JonesTrading.

We will report at least quarterly the number of shares of common stock sold through JonesTrading under the Sales Agreement, the net proceeds to us and the compensation paid by us to JonesTrading in connection with the sales of common stock.

Settlement for sales of common stock will occur, unless the parties agree otherwise, on the third business day that is also a trading day following the date on which any sales were made in return for payment of the net proceeds to us. There is no arrangement for funds to be received in an escrow, trust or similar arrangement.

In connection with the sales of the common stock on our behalf, JonesTrading may be deemed to be an “underwriter” within the meaning of the Securities Act, and the compensation paid to JonesTrading may be deemed to be underwriting commissions or discounts. We have agreed in the Sales Agreement to provide indemnification and contribution to JonesTrading against certain liabilities, including liabilities under the Securities Act. In addition, we have agreed to reimburse a portion of the expenses of JonesTrading in connection with this offering up to a maximum of \$50,000.

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We estimate that the total expenses of the offering payable by us, excluding commissions payable to JonesTrading under the Sales Agreement, will be approximately \$100,000.

We and JonesTrading each have the right, by giving written notice as specified in the Sales Agreement, to terminate the Sales Agreement in each party's sole discretion at any time.

EXPERTS

The financial statements in our Annual Report on Form 10-K for the year ended December 31, 2010 have been audited by Hein & Associates LLP, an independent registered public accounting firm, to the extent and for the periods set forth in their report, and are incorporated in this prospectus supplement by reference in reliance upon such report and upon the authority of such firm as experts in accounting and auditing.

LEGAL MATTERS

Certain legal matters with respect to the common stock will be passed upon for us by Faegre Baker Daniels LLP, Boulder, Colorado. Certain legal matters in connection with the offering of the common stock will be passed upon for JonesTrading by LeClairRyan, A Professional Corporation, Newark, New Jersey.

INFORMATION INCORPORATED BY REFERENCE

This prospectus supplement and the accompanying prospectus are part of a registration statement on Form S-3. The SEC allows this filing to "incorporate by reference" information that we previously filed with the SEC. This means we can disclose important information to you by referring you to other documents that we have filed with the SEC. The information that is incorporated by reference is considered part of this prospectus supplement, and information that we file later will automatically update and may supersede this information. For further information about us and the securities being offered, you should refer to the registration statement and the following documents that are incorporated by reference:

• Our annual report on Form 10-K filed on February 28, 2011, which contains audited financial statements for the fiscal year ended December 31, 2010;

• Our definitive proxy statement on Schedule 14A filed on April 27, 2011;

• Our quarterly reports on Forms 10-Q filed on April 28, 2011, August 15, 2011 and November 10, 2011;

• Our current reports on Form 8-K filed on April 6, 2011, June 16, 2011, August 15, 2011, October 13, 2011, October 27, 2011, November 3, 2011, November 22, 2011, January 5, 2012 and February 3, 2012;

• All other reports filed by us pursuant to Section 13(a) or 15(d) of the Exchange Act since the end of the fiscal year covered by the annual report referred to above; and

• The description of our common stock contained in Forms 8-A filed on June 19, 2006 and August 8, 2006 and any amendments or reports filed for the purpose of updating such description.

All documents filed by us subsequent to those listed above with the SEC pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act and, prior to the termination of the offering, shall be deemed to be incorporated by reference into this prospectus supplement and to be a part hereof from the date of filing of such documents. Any statement contained in a document incorporated by reference herein shall be deemed to be modified or superseded for purposes of this prospectus supplement to the extent that a statement contained herein or in any other subsequently filed document which also is or is deemed to be incorporated by reference herein modifies or supersedes such statement. Any statement so modified or superseded shall not be deemed, except as so modified or superseded, to constitute a part of this prospectus supplement.

You may request a copy of all documents that are incorporated by reference in this prospectus by writing or telephoning us at the following address and number: Ascent Solar Technologies, Inc., Attention: Corporate Secretary, 12300 Grant Street, Thornton, Colorado 80241, (720) 872-5000. We will provide copies of all documents requested (not including exhibits to those documents, unless the exhibits are specifically incorporated by reference into those documents or this prospectus) without charge.

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We file annual, quarterly and special reports, proxy statements and other information with the SEC. You may read and copy any document we file at the SEC's Public Reference Room at 100 F Street, N.E., Washington, D.C. 20549. Please call the SEC at 1-800-SEC-0330 for more information about the operation of the Public Reference Room. The SEC maintains an Internet site that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC, including Ascent Solar Technologies, Inc. The SEC's Internet site can be found at www.sec.gov.

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The information in this prospectus is not complete and may be changed. These securities may not be sold until the related registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities and it is not soliciting an offer to buy these securities in any state where the offer or sale is not permitted.

PROSPECTUS

ASCENT SOLAR TECHNOLOGIES, INC.

Up to \$25,000,000

COMMON STOCK
PREFERRED STOCK
WARRANTS

We may sell from time to time the securities offered by this prospectus at prices and on terms to be determined at or prior to the time of each sale. We will describe the specific terms and amounts of the securities offered in a prospectus supplement for each sale. You should carefully read this prospectus and any prospectus supplement before you invest. This prospectus may not be used to sell securities unless accompanied by a prospectus supplement.

Our common stock is traded on the Nasdaq Global Market under the symbol "ASTI." On February 3, 2012, the last reported sale price of our common stock on the Nasdaq Global Market was \$0.81 per share.

On the date of this prospectus, the aggregate market value of our outstanding voting and non voting common equity held by non-affiliates is \$20.0 million. Within the last 12 months we have not sold any securities pursuant to General Instruction I.B.6 to Form S-3.

Our principal executive offices are located at 12300 North Grant Street, Thornton, Colorado 80241.

These are speculative securities. Investing in these securities involves significant risks. You should purchase these securities only if you can afford a complete loss of your investment. See "Risk Factors" beginning on page 2.

This prospectus may not be used to consummate a sale of any securities unless accompanied by a prospectus supplement.

The securities offered by this prospectus may be sold directly by us to investors, through agents designated from time to time or to or through underwriters or dealers, on a continuous or delayed basis. For additional information on the methods of sale, you should refer to the section entitled "Plan of Distribution" in this prospectus. If any agents or underwriters are involved in the sale of any securities with respect to which this prospectus is being delivered, the names of such agents or underwriters and any applicable fees, commissions, discounts and over-allotment options will be set forth in a prospectus supplement. The price to the public of such securities and the net proceeds that we expect to receive from such sale will also be set forth in a prospectus supplement.

NEITHER THE SECURITIES AND EXCHANGE COMMISSION NOR ANY STATE SECURITIES COMMISSION HAS APPROVED OR DISAPPROVED OF THESE SECURITIES OR PASSED UPON THE ADEQUACY OR ACCURACY OF THIS PROSPECTUS. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

The date of this prospectus is February 3, 2012

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In this prospectus, references to “we,” “us,” “our,” “Ascent,” “Ascent Solar” or the “Company” mean Ascent Solar Technologies, Inc.

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ABOUT THIS PROSPECTUS

This prospectus is part of a Registration Statement on Form S-3 that we filed with the Securities and Exchange Commission (“SEC”) using a “shelf” registration process. Under this shelf process, we may sell any combination of securities described in this prospectus in one or more offerings, up to the total dollar amounts appearing on the cover of this prospectus. This prospectus provides you with a general description of the securities we may offer. Each time we offer the securities, a prospectus supplement will be provided that will contain specific information about the terms of the offering, including the types(s), amount(s) and price(s) of the securities being offered and the plan of distribution. The prospectus supplement for a particular offering may also add, update or change information contained in this prospectus. In addition, any prospectus supplement relating to a particular offering may be updated or supplemented. You should read carefully both this prospectus and any applicable prospectus supplement together with the additional information about us to which we refer you in the section of this prospectus entitled “Where You Can Find More Information.” This prospectus may not be used to consummate a sale of any securities unless accompanied by a prospectus supplement.

You should rely only on the information contained or incorporated by reference in this prospectus or a prospectus supplement. We have not authorized any other person to provide you with different information. If anyone provides you with different or inconsistent information, you should not rely on it. You should not assume that the information appearing in this prospectus, any prospectus supplement or any document incorporated by reference is accurate as of any date other than its date, regardless of the time of delivery of the prospectus or prospectus supplement or any sale of securities. Our business, financial condition, results of operations and prospects may have changed since those dates.

PROSPECTUS SUMMARY

This summary highlights information contained in this prospectus. While we believe that this summary highlights some of the most important information about Ascent Solar Technologies, Inc. and this offering, you should read this entire prospectus and the documents incorporated by reference carefully, including “Risk Factors,” before deciding to invest in our securities.

Overview

We are a development stage company formed in October 2005 to commercialize flexible photovoltaic (“PV”) modules using proprietary technology. Our technology was initially developed at ITN Energy Systems, Inc. (“ITN”) by our founder and core scientific team beginning in 1994 and subsequently assigned and licensed to us. Our proprietary manufacturing process deposits multiple layers of materials, including a thin film of highly efficient copper-indium-gallium-diselenide (“CIGS”) semiconductor material, on a flexible, lightweight, plastic substrate and then laser patterns the layers to create interconnected PV cells, or PV modules, in a process known as monolithic integration. We believe that our technology and manufacturing process provide us with significant advantages over both the crystalline silicon based PV manufacturers that currently dominate the PV market, as well as other thin-film PV manufacturers that use rigid and/or heavier substrate materials such as glass, stainless steel or other metals. Our target markets include the building integrated PV (“BIPV”) market, the building applied PV (“BAPV”) market, the electronic integrated PV (“EIPV”) market, the military and governmental portable power markets and the space and near-space markets.

We completed construction of our FAB1 production line in December 2007. In 2008 we began placing purchase orders for equipment to be installed in our second production facility (“FAB2”) and purchased an existing building in Thornton, Colorado. During 2008 and early 2009, the building was renovated to accommodate our manufacturing requirements. In 2009, we began receiving production equipment in FAB2 and started qualification of the equipment. Throughout 2010, we continued qualification of the equipment in FAB2 and began production of PV modules. Currently we are in limited production utilizing a combination of equipment from our FAB1 and FAB2 production lines. We are qualifying equipment that has been delivered and additional equipment is scheduled for delivery in 2012 and we have adjusted our utilization of equipment based on our near term forecast. Under our current business plan,

we expect losses to continue until annual production reaches approximately 30 MW or more. We intend to augment our own manufacturing capabilities by licensing our proprietary manufacturing processes to others. We plan to continue manufacturing at our current facilities; however, our plans are to have significant future production capacity enabled through partnerships, joint ventures or other commercial or licensing arrangements. To date, we have financed our operations primarily through public and private equity financings.

On August 12, 2011, we entered into an investment and strategic alliance with TFG Radiant Investment Group Ltd. and its affiliates (“TFG Radiant”), pursuant to which TFG Radiant made an initial \$7.36 million equity investment in us, and, in connection with such investment, received an option to acquire an additional 9,500,000 shares our common stock at an exercise price of \$1.55 per share.

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In addition, in exchange for the grant by the Company of exclusive rights to manufacture and sell solar devices based on the Company's proprietary CIGS PV technology in East Asia (comprised of China, Taiwan, Hong Kong, Thailand, Malaysia, Indonesia, Korea and Singapore), TFG Radiant has committed to invest \$165 million to build an initial fab in East Asia using the Company's proprietary processes for manufacturing flexible CIGS PV, will provide consulting fees to the Company in connection with installation and commissioning of any fabs in East Asia, will provide license fees, royalty payments, and ownership interest in all East Asia fabs, and subject to the East Asia fabs meeting certain milestones related to production and costs, will provide over time incentive payments to the Company of up to \$250 million.

On December 30, 2011 TFG Radiant agreed to purchase 8,067,390 shares of the Company's common stock presently owned by Norsk Hydro. This transaction is expected to close during the first quarter of 2012. Upon the closing of this transaction, TFG Radiant's ownership would increase to approximately 41 percent of the Company's outstanding common stock.

We believe that there remains strong interest in renewable energy in general and solar in particular, but existing global political and financial conditions are significantly disrupting key solar markets. Throughout 2011, there was a reduction in the then-current and expected average selling prices for PV modules. This was a result of many factors, most significantly the increased industry-wide manufacturing capacity, which has contributed to excess industry channel inventories, and a concurrent scaling back of government subsidies and incentives related to solar energy. As a result of these recent significant adverse changes in market conditions, the Company concluded that the carrying value of its property, plant and equipment might not be recoverable. This analysis utilized projected selling prices and operating costs under alternative scenarios to arrive at total estimated undiscounted cash flows. As a result of the analysis, in the second quarter of 2011 the Company used discounted cash flows to calculate and record an impairment loss of \$78.0 million in the carrying value of property, plant and equipment and deposits on manufacturing equipment.

We are a development stage company and we have a history of net losses. As of September 30, 2011, we had an accumulated deficit of approximately \$177.4 million, including a net loss of approximately \$100.2 million for the nine months ended September 30, 2011 and a net loss of \$21.5 million for the nine months ended September 30, 2010. As of December 31, 2011, the Company had approximately \$23.9 million in cash and investments. As discussed above, the Company is in the development stage and is currently incurring significant losses from operations as it works toward commercialization. The Company commenced limited production on its initial production line in the first quarter of 2009 and the second production line in 2010. The Company does not expect that sales revenue and cash flows from product revenue will be sufficient to support operations and cash requirements until actual full production capacity is achieved. Changes in the level of expected operating losses, the timing of planned capital expenditures or other factors may negatively impact cash flows and reduce current cash and investments faster than anticipated. The Company expects that it will need to raise additional capital in the future. There is no assurance that the Company will be able to raise additional capital on acceptable terms or at all.

Corporate Information

We are incorporated under the laws of Delaware. Our principal business office is located at 12300 North Grant Street, Thornton, Colorado 80241, and our telephone number is (720) 872-5000. Our website address is www.ascentsolar.com. Information contained on our website or any other website does not constitute part of this prospectus.

This Offering

Through this prospectus, we may from time to time offer and sell shares of our common stock, shares of our preferred stock, warrants, and the securities issuable upon exercise or conversion of any of those securities. We may offer and sell these securities separately or together as units, but the aggregate initial offering price will not to exceed \$25,000,000 or the equivalent amount denominated in one or more foreign currencies. Each time we offer and sell the

securities, a prospectus supplement will be provided that will contain specific information about the terms of the offering, including the type(s), amounts(s) and price(s) of the securities being offered and the plan of distribution employed.

FORWARD-LOOKING STATEMENTS

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Overview

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This Offering

Through this prospectus, we may from time to time offer and sell shares of our common stock, shares of our preferred stock, warrants, and the securities issuable upon exercise or conversion of any of those securities. We may offer and sell these securities separately or together as units, but the aggregate initial offering price will not to exceed \$25,000,000 or the equivalent amount denominated in one or more foreign currencies. Each time we offer and sell the securities, a prospectus supplement will be provided that will contain specific information about the terms of the offering, including the type(s), amount(s) and price(s) of the securities being offered and the plan of distribution employed.

RISK FACTORS

An investment in our securities involves a high degree of risk and many uncertainties discussed in the section entitled "Risk Factors" in our annual report on Form 10-K for the year ended December 31, 2010, which is incorporated by reference into this prospectus. You should carefully consider the risk factors before purchasing our securities. If one or more of the possibilities described as risks actually occurs, our operating results and financial condition would likely suffer and the trading price of our securities could fall, causing you to lose some or all of your investment in the securities we are offering.

USE OF PROCEEDS

Unless otherwise indicated in the applicable prospectus supplement, we intend to use the net proceeds from the sale of any securities offered under this prospectus for general corporate purposes, including repayment and refinancing of debt, working capital and capital expenditures, research and development expenses, general and administrative expenses, or investment in technologies, products or assets that complement our business. We may temporarily invest the net proceeds in investment-grade and U.S. government interest-bearing securities until they are used for their stated purpose. We have not determined the amount of net proceeds to be used specifically for such purposes. As a result, management will retain broad discretion over the allocation of net proceeds.

DILUTION

If required by SEC rules, we will set forth in a prospectus supplement the following information regarding any material dilution of the equity interests of investors purchasing securities in an offering under this prospectus:

- * the net tangible book value per share of our equity securities before and after the offering;
- * the amount of the increase in such net tangible book value per share attributable to the cash payments made by purchases in the offering; and
- * the amount of the immediate dilution from the public offering price which will be absorbed by such purchasers.

PLAN OF DISTRIBUTION

We may sell the securities being offered hereby in one or more of the following ways from time to time:
through dealers or agents to the public or to investors;

to underwriters for resale to the public or to investors;

directly to investors; or

through a combination of such methods.

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We may sell the securities at a fixed price or prices that may change, at prevailing market prices, at prices relating to prevailing market prices or at negotiated prices. Each time we sell securities in a particular offering, we will set forth in a prospectus supplement the terms of the offering of securities, including:

- the material terms of the distribution, including the number of shares and the consideration paid;
- the identity of any underwriters, dealers, agents or purchasers that will purchase the securities;
- the type and amount of any compensation, discounts or commissions to be received by underwriters, dealers or agents;
- the purchase price of the securities being offered and the proceeds we will receive from the sale;
- the nature of any transactions by underwriters, dealers or agents during the offering that are intended to stabilize or maintain the market price of our securities; and
- the terms of any indemnification provisions.

Underwriters, dealers and agents that participate in the distribution of the securities may be deemed to be underwriters as defined in the Securities Act of 1933, as amended (the “Securities Act”), and any discounts or commissions they receive from us and any profit on their resale of the securities may be treated as underwriting discounts and commissions under the Securities Act. We will identify in the applicable prospectus supplement any underwriters, dealers or agents and will describe their compensation. We may have agreements with the underwriters, dealers and agents to indemnify them against specified civil liabilities, including liabilities under the Securities Act. Underwriters, dealers and agents may engage in transactions with or perform services for us or our subsidiary in the ordinary course of their businesses.

Certain persons that participate in the distribution of the securities may engage in transactions that stabilize, maintain or otherwise affect the price of the securities, including over-allotment, stabilizing and short-covering transactions in such securities, and the imposition of penalty bids, in connection with an offering. Certain persons may also engage in passive market-making transactions as permitted by Rule 103 of Regulation M. Passive market makers must comply with applicable volume and price limitations and must be identified as passive market makers. In general, a passive market maker must display its bid at a price not in excess of the highest independent bid for such security; if all independent bids are lowered below the passive market maker’s bid, however, the passive market maker’s bid must then be lowered when certain purchase limits are exceeded.

DESCRIPTION OF SECURITIES

Our authorized capital stock consists of 125,000,000 shares of common stock, \$0.0001 par value, and 25,000,000 shares of preferred stock, \$0.0001 par value. As of December 31, 2011 we had 39,345,459 shares of common stock and no shares of preferred stock outstanding.

The following is a summary of the rights of our common stock, preferred stock and certain outstanding rights to obtain our common stock. For more detailed information about our capital stock, please see our certificate of incorporation and bylaws, both as amended (our “Certificate of Incorporation” and “Bylaws,” respectively).

Common Stock

Holders of our common stock are entitled to one vote for each share on all matters submitted to a stockholder vote and may not cumulate their votes. Holders of common stock are entitled to share in all dividends that our Board of Directors (our “Board”), in its discretion, declares from legally available funds. In the event of our liquidation, dissolution or winding up, each outstanding share entitles its holder to participate pro rata in all assets that remain after payment of liabilities and after providing for each class of stock, if any, having preference over the common

stock.

Except for Norsk Hydro and TFG Radiant, which hold pre-emptive rights with respect to certain equity issuances by us (on terms no less favorable than any such issuance) in order to maintain their percentage ownership in our common stock, no other holders of our common stock have any conversion, preemptive or other subscription rights, and there are no redemption provisions applicable to our common stock. The rights of the holders of common stock are subject to any rights that may be fixed for holders of preferred stock.

Preferred Stock

Our Board is authorized by our Certificate of Incorporation to establish classes or series of preferred stock and fix the

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designation, powers, preferences and rights of the shares of each such class or series and the qualifications, limitations or restrictions thereof without any further vote or action by our stockholders. Any shares of preferred stock so issued could have priority over our common stock with respect to dividend or liquidation rights. Any future issuance of preferred stock may have the effect of delaying, deferring or preventing a change in our control without further action by our stockholders and may adversely affect the voting and other rights of the holders of our common stock. At present we have no plans to issue any shares of preferred stock or to adopt any new series, preferences or other classification of preferred stock.

The issuance of shares of preferred stock, or the issuance of rights to purchase such shares, could be used to discourage an unsolicited acquisition proposal. For instance, the issuance of a series of preferred stock might impede a business combination by including class voting rights that would enable a holder to block such a transaction. In addition, under certain circumstances, the issuance of preferred stock could adversely affect the voting power of holders of our common stock. Although our Board is required to make any determination to issue preferred stock based on its judgment as to the best interests of our stockholders, our Board could act in a manner that would discourage an acquisition attempt or other transaction that some, or a majority, of our stockholders might believe to be in their best interests or in which such stockholders might receive a premium for their stock over the then market price of such stock. Our Board presently does not intend to seek stockholder approval prior to the issuance of currently authorized stock, unless otherwise required by law or applicable stock exchange rules.

Authorized but Unissued Shares

The authorized but unissued shares of common and preferred stock are available for future issuance without stockholder approval, unless otherwise required by law or applicable stock exchange rules. These additional shares may be used for a variety of corporate purposes, including future public offerings to raise additional capital, corporate acquisitions and employee benefit plans. The existence of authorized but unissued shares could hinder or discourage an attempt to obtain control of us by means of a proxy contest, tender offer, merger or otherwise.

Warrants

We may issue warrants to purchase our debt or equity securities or other rights, including rights to receive payment in cash or securities based on the value, rate or price of one or more specified commodities, currencies, securities or indices, or any combination of the foregoing. Warrants may be issued independently or together with any other securities and may be attached to, or separate from, such securities. Each series of warrants will be issued under a separate warrant agreement to be entered into between us and a warrant agent. The terms of any warrants to be issued and a description of the material provisions of the applicable warrant agreement will be set forth in the applicable prospectus supplement.

The applicable prospectus supplement will describe the following terms of any warrants in respect of which this prospectus is being delivered:

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- * the title of such warrants;
- * the aggregate number of such warrants;
- * the price or prices at which such warrants will be issued;
- * the currency or currencies, in which the price of such warrants will be payable;
- * the securities or other rights, including rights to receive payment in cash or securities based on the value, rate or price of one or more specified commodities, currencies, securities or indices, or any combination of the foregoing, purchasable upon exercise of such warrants;
- * the price at which and the currency or currencies, in which the securities or other rights purchasable upon exercise of such warrants may be purchased;
- * the date on which the right to exercise such warrants shall commence and the date on which such right shall expire;
- * if applicable, the minimum or maximum amount of such warrants which may be exercised at any one time;
- * if applicable, the designation and terms of the securities with which such warrants are issued and the number of such warrants issued with each such security;
- * if applicable, the date on and after which such warrants and the related securities will be separately transferable;
- * information with respect to book-entry procedures, if any;
- * if applicable, a discussion of any material U.S. federal income tax considerations; and
- * any other material terms of such warrants, including terms, procedures and limitations relating to the exchange and exercise of such warrants.

2005 Stock Option Plan

Our 2005 Stock Option Plan, as amended (the “Option Plan”), currently authorizes the grant of up to 3,700,000 shares of common stock (subject to adjustment for stock splits and similar capital changes) in connection with incentive stock option grants and non-qualified stock option grants. Employees and, in the case of nonqualified stock options, directors, consultants or other service providers are eligible to receive grants under our plans. According to the terms of the Option Plan, no employee may be granted, in any fiscal year, options to purchase more than 100,000 shares. As of December 31, 2011, there were outstanding and unexercised options to purchase 1,445,901 shares under our Option Plan.

2008 Restricted Stock Plan

Our 2008 Restricted Stock Plan, as amended (the “Stock Plan”), currently authorizes the grant of up to 1,550,000 shares of restricted common stock and restricted stock units (subject to adjustment for stock splits and similar capital

changes) to employees, directors, consultants or other service providers. According to the terms of the Stock Plan, no individual may be granted, in any fiscal year, more than 200,000 shares. Vesting of shares of restricted stock granted under the Stock Plan may occur over a specified period of time or based upon performance metrics announced at the time of grant. As of December 31, 2011, 1,234,052 restricted stock units had been granted under our Stock Plan, of which 639,759 were vested and released, 353,543 were canceled and 240,750 are currently unvested and outstanding.

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TFG Radiant Option

Pursuant to the Securities Purchase Agreement entered into on August 12, 2011 with TFG Radiant, we granted TFG Radiant an option to purchase 9,500,000 shares of our common stock. This option will only become exercisable under certain terms and conditions, including, among other things, TFG Radiant achieving certain performance milestones related to the construction of an initial PV module manufacturing facility located in Asia. This option will terminate if it becomes exercisable and then it is not exercised on or before February 12, 2014. If a change of control transaction occurs prior to such expiration date, this option will become immediately exercisable and will terminate unless exercised in connection with such change of control transaction. If this option becomes exercisable, the shares would be sold to TFG Radiant at a per share price equal to \$1.55 per share, or an aggregate of \$14,725,000.

Registration Rights

In connection with the sale of certain of our securities, Norsk Hydro received piggyback registration rights that enable them to require us to register for resale the shares held by them if we engage in a registered public offering; and also certain demand registration rights. Upon the closing of the currently pending sale of Norsk Hydro's shares to TFG Radiant, TFG Radiant will receive certain demand and piggyback registration rights.

Anti-Takeover Effects of Certain Provisions of Delaware Law and Our Certificate of Incorporation and Bylaws

Our Certificate of Incorporation and Bylaws contain a number of provisions that could make our acquisition by means of a tender or exchange offer, a proxy contest or otherwise more difficult. These provisions are summarized below.

Removal of Directors. Our Bylaws provide that our directors may only be removed by the affirmative vote of the shares entitled to vote at an election of directors, or for cause by a majority of the Board. Although our Bylaws do not give the Board the power to approve or disapprove stockholder nominations for the election of directors or of any other business stockholders desire to conduct at an annual or any other meeting, the Bylaws may have the effect of precluding a nomination for the election of directors or precluding the conduct of business at a particular annual meeting if the proper procedures are not followed, or discouraging or deterring a third party from conducting a solicitation of proxies to elect its own slate of directors or otherwise attempting to obtain control, even if the conduct of that solicitation or attempt might be beneficial to our stockholders.

Staggered Board. Staggered terms tend to protect against sudden changes in management and may have the effect of delaying, deferring or preventing a change in our control without further action by our stockholders. Our Board is divided into three classes, with one class of directors elected at each year's annual stockholder meeting.

Special Meetings. Our Bylaws provide that special meetings of stockholders can be called by the President, at the request of a majority of the Board or at the written request of holders of at least 50% of the shares outstanding and entitled to vote.

Undesignated Preferred Stock. The ability to authorize undesignated preferred stock makes it possible for our Board of Directors to issue preferred stock with voting or other rights or preferences that could impede the success of any attempt to acquire us. These and other provisions may have the effect of deferring hostile takeovers or delaying changes in control or management of our Company.

Delaware Anti-Takeover Statute. We are subject to the provisions of Section 203 of the Delaware General Corporation Law regulating corporate takeovers. In general, Section 203 prohibits a publicly held Delaware corporation from engaging under certain circumstances in a business combination with an interested stockholder for a period of three years following the date the person became an interested stockholder unless:

Prior to the date of the transaction that resulted in the stockholder becoming an interested stockholder, the board of directors of the corporation approved either the business combination or the transaction which resulted in the stockholder becoming an interested stockholder.

Upon completion of the transaction that resulted in the stockholder becoming an interested stockholder, the stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the number of shares outstanding (1) shares owned by persons who are directors and also officers and (2) shares owned by employee stock plans in which employee participants do not have the right to determine confidentially whether shares held subject to the plan will be tendered in a tender or exchange offer.

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On or subsequent to the date of the transaction that resulted in the stockholder becoming an interested stockholder, the business combination is approved by the board and authorized at an annual or special meeting of stockholders, and not by written consent, by the affirmative vote of at least 66²/₃% of the outstanding voting stock which is not owned by the interested stockholder.

Generally, a business combination includes a merger, asset or stock sale, or other transaction resulting in a financial benefit to the interested stockholder. An interested stockholder is a person who, together with affiliates and associates, owns or, within three years prior to the determination of interested stockholder status, did own 15% or more of a corporation's outstanding voting securities. We expect the existence of this provision to have an anti-takeover effect with respect to transactions our Board does not approve in advance. We also anticipate that Section 203 may also discourage attempts that might result in a premium over the market price for the shares of common stock held by stockholders.

The provisions of Delaware law, our Certificate of Incorporation and our Bylaws could have the effect of discouraging others from attempting hostile takeovers and, as a consequence, they may also inhibit temporary fluctuations in the market price of our common stock that often result from actual or rumored hostile takeover attempts. These provisions may also have the effect of preventing changes in our management. It is possible that these provisions could make it more difficult to accomplish transactions that stockholders may otherwise deem to be in their best interests.

Listing

Our common stock is listed on the Nasdaq Global Market under the trading symbol "ASTI."

Transfer Agent and Registrar

The transfer agent and registrar of our common stock is Computershare Investor Services.

EXPERTS

The financial statements included in our annual report on Form 10-K for the year ended December 31, 2010 and incorporated into this prospectus by reference have been audited by Hein & Associates LLP, an independent registered public accounting firm, to the extent and for the periods set forth in their report, and are incorporated in this prospectus by reference in reliance upon such report given upon the authority of them as experts in auditing and accounting.

LEGAL MATTERS

The validity of the securities offered hereby will be passed on by Faegre Baker Daniels LLP, Boulder, Colorado.

INFORMATION INCORPORATED BY REFERENCE

This prospectus is part of a registration statement on Form S-3. The SEC allows this filing to "incorporate by reference" information that the Company previously has filed with the SEC. This means the Company can disclose important information to you by referring you to other documents that it has filed with the SEC. The information that is incorporated by reference is considered part of this prospectus, and information that the Company files later will automatically update and may supersede this information. For further information about the Company and the securities being offered, you should refer to the registration statement and the following documents that are incorporated by reference:

• Our annual report on Form 10-K filed on February 28, 2011, which contains audited financial statements for the fiscal year ended December 31, 2010;

• Our definitive proxy statement on Schedule 14A filed on April 27, 2011;

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• Our quarterly reports on Form 10-Q filed on April 28, 2011, August 15, 2011 and November 10, 2011;

- Our current reports on Form 8-K filed on April 6, 2011, June 16, 2011, August 15, 2011, October 13, 2011, October 27, 2011, November 3, 2011, November 22, 2011, January 5, 2012 and February 3, 2012;

• All other reports filed by us pursuant to Section 13(a) or 15(d) of the Exchange Act since the end of the fiscal year covered by the annual report referred to above; and

• The description of our common stock contained in Forms 8-A filed on June 19, 2006 and August 8, 2006 and any

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amendments or reports filed for the purpose of updating such description.

All documents filed by the Company subsequent to those listed above with the SEC pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act, prior to the termination of the offering, shall be deemed to be incorporated by reference into this prospectus and to be a part hereof from the date of filing of such documents. Any statement contained in a document incorporated by reference herein shall be deemed to be modified or superseded for purposes of this prospectus to the extent that a statement contained herein or in any other subsequently filed document which also is or is deemed to be incorporated by reference herein modifies or supersedes such statement. Any statement so modified or superseded shall not be deemed, except as so modified or superseded, to constitute a part of this prospectus.

You may request a copy of all documents that are incorporated by reference in this prospectus by writing or telephoning us at the following address and number: Ascent Solar Technologies, Inc., Attention: Corporate Secretary, 12300 North Grant Street, Thornton, Colorado 80241, telephone (720) 872-5000. We will provide copies of all documents requested (not including exhibits to those documents, unless the exhibits are specifically incorporated by reference into those documents or this prospectus) without charge.

WHERE YOU CAN FIND MORE INFORMATION

This prospectus is part of a registration statement on Form S-3 filed with the SEC under the Securities Act. This prospectus does not contain all the information set forth in the registration statement because certain information has been incorporated into the registration statement by reference in accordance with the rules and regulations of the SEC. Please review the documents incorporated by reference for a more complete description of the matters to which such documents relate.

We are subject to the informational reporting requirements of the Exchange Act. In accordance with the Exchange Act, we file reports, proxy statements, and other information with the SEC. You can inspect and copy these reports, proxy statements, and other information at the Public Reference Room of the SEC, 100 F Street, N.E., Washington, D.C. 20549, at prescribed rates. Please call the SEC at 1-800-SEC-0330 for further information on the operation of the public reference rooms. Our SEC filings are also available on the SEC's web site. The address of this site is <http://www.sec.gov>.

INDEMNIFICATION

Our Certificate of Incorporation contains provisions that limit the liability of our directors for monetary damages to the fullest extent permitted by Delaware law. Consequently, our directors will not be personally liable to stockholders for monetary damages for any breach of fiduciary duties as directors, except liability for the following:

- Any breach of their duty of loyalty to our company or our stockholders;
- Acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law;
- Unlawful payments of dividends or unlawful stock repurchases or redemptions as provided in Section 174 of the Delaware General Corporation Law; and
- Any transaction from which the director derived an improper personal benefit.

Our Bylaws provide that we are required to indemnify our directors and officers and may indemnify our employees and other agents to the fullest extent permitted by Delaware law. Our Bylaws also provide that we shall advance expenses incurred by a director or officer before the final disposition of any action or proceeding upon receipt of an undertaking from or on behalf of that director or officer to repay the advance if it is ultimately determined that he or she is not entitled to be indemnified. We have entered and expect to continue to enter into agreements to indemnify

our directors, executive officers and other employees as determined by the Board. These agreements provide for indemnification for related expenses including attorneys' fees, judgments, fines and settlement amounts incurred by any of these individuals in any action or proceeding. We believe that these provisions and indemnification agreements are necessary to attract and retain qualified persons as directors and officers. We also maintain directors' and officers' liability insurance.

The limitation of liability and indemnification provisions in our Certificate of Incorporation and Bylaws may discourage stockholders from bringing a lawsuit against our directors for breach of their fiduciary duty. They may also reduce the likelihood of derivative litigation against our directors and officers, even though an action, if successful, might benefit us and other stockholders. Furthermore, a stockholder's investment may be adversely affected to the extent that we pay the costs of settlement and damage awards against directors and officers as required by these indemnification provisions. At present, there is no pending litigation or proceeding involving any of our directors, officers or employees regarding which indemnification is

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sought, and we are not aware of any threatened litigation that may result in claims for indemnification.

DISCLOSURE OF COMMISSION POSITION ON INDEMNIFICATION OF SECURITIES ACT
LIABILITIES

Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers or persons controlling us pursuant to the foregoing provisions, we have been informed that in the opinion of the SEC such indemnification is against public policy as expressed in the Securities Act and is therefore unenforceable.

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Up to \$5,000,000
Common Stock

PROSPECTUS SUPPLEMENT
February 24, 2012

Neither we nor the agent have authorized anyone to provide information different from that contained in this prospectus supplement. When you make a decision about whether to invest in our common stock, you should not rely upon any information other than the information in this prospectus supplement or the accompanying prospectus. Neither the delivery of this prospectus supplement nor the sale of our common stock means that information contained in this prospectus supplement is correct after the date of this prospectus supplement. This prospectus supplement is not an offer to sell or solicitation of an offer to buy these shares of common stock in any circumstances under which the offer or solicitation is unlawful.