



BRIEF CASES

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PV Technologies, Inc.: Were They Asleep at the Switch?

As a global leader in the photovoltaic (PV)¹ inverter industry, PV Technologies (PVT) was a dominant supplier to several segments of the solar energy technology field, among them power plant developers whose installations ranged from 10 megawatts (MW) to more than 200MW. In late July 2011, PVT received a Request for Proposal (RFP) from a long-time client, Solenergy Development LLC, a major developer of energy generation systems. Solenergy had won a large contract from the City of Barstow, California, to construct a PV solar energy power plant and was seeking a supplier of utility scale central inverters. The 100MW plant was to be situated adjacent to an existing 25MW plant in which PVT's central inverters had been installed three years earlier and were performing flawlessly. The closing date for the response to the RFP was October 31, 2011.

Nathan Rubenstein, PVT's Director of Sales and Marketing, was optimistic about his firm's chances of winning the contract for this high-visibility project. Solenergy was one of the largest customers of PVT's solar energy business unit. The relationship with Solenergy's senior management team was solid and strong, and the excellent performance of PVT's products in the existing facility was indisputable. Moreover, PVT's best salesperson, Jim Salvatori, who had brought Solenergy to PVT shortly after he joined, would be managing PVT's response to Solenergy's RFP.

Solenergy conducted periodic confidential evaluations of the select group of companies it invited to bid on its major projects. The evaluations examined the firms' financial conditions as well as the products they manufactured, many of which were installed in Solenergy projects. An abbreviated update customarily followed the issuance of an RFP. The evaluations, though not necessarily final, often foretold the ultimate outcome of the bidding. There was extra pressure on bidders for major projects because these evaluations were directed by Greg Morgan, the widely respected chief electrical engineer at Solenergy, whose judgments were highly influential throughout the industry. Further, Solenergy often included his comments in press releases as a reflection of its sensitivity to its responsibilities and influence as a leading solar energy developer.

¹ **Photovoltaics (PV)** is a method of generating electrical power by converting solar radiation into direct current electricity.

HBS Professor Frank Cespedes and Professor Diane Badame, Marshall School of Business, University of Southern California, prepared this case solely as a basis for class discussion and not as an endorsement, a source of primary data, or an illustration of effective or ineffective management. Although based on real events and despite occasional references to actual companies, this case is fictitious and any resemblance to actual persons or entities is coincidental. The authors thank HBS Professor E. Raymond Corey, whose work informed the development of this case.

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So it was a very agitated Salvatori who rushed into Rubenstein's office in late November. Salvatori said he'd heard that Morgan's evaluation, conducted in conjunction with the issuance of the RFP's for the Barstow bids, showed PVT trailing the other competitors—SOMA Energy and BJ Solar. The bids were in. The evaluations were completed. Salvatori believed that Solenergy was close to or had already made the purchase decision.

Rubenstein was troubled that Salvatori had learned of the evaluation through his network instead of directly from Morgan. Given the confidential nature of the document, this was arguably a lapse in ethical conduct. Additionally, Rubenstein wondered if Salvatori's long relationship with Morgan shouldn't have surfaced the issues even sooner. But Rubenstein couldn't concentrate on these concerns just yet. Solenergy's leadership role in the industry and the tacit endorsement that accompanied its selection of vendors, coupled with an industrywide focus on cost cutting (championed by Solenergy), were his principal concerns.

Salvatori's sources were vague; they believed the evaluation was based largely on price but weren't certain this was the only factor. Rubenstein and Salvatori found this uncertainty even more disturbing than a negative rating based on a concrete and specific argument, which they had a better chance of combating. Morgan's updated evaluation would undoubtedly drive the purchase decision, and a potentially damaging press release announcing the successful bidder could be published tomorrow—or two weeks from now . . . if ever.

Rubenstein and Salvatori now had to decide what actions to take, if any, to elevate PVT out of third place. "It isn't just this contract," Rubenstein said. "Our reputation and position in the marketplace are at stake."

Company Background

Founded in 1993 in San Francisco, California, PVT was a global specialist in renewable energy. The firm had a solid balance sheet as well as strong profitability and cash flow and had made substantial investments in R&D and technology over the years to achieve and maintain industry-leading product innovativeness, quality, and performance. With \$30 billion in revenues in 2010, PVT served the electric power industry and large-scale solar project developers in more than 25 countries. By October 2011, global revenue from the PV inverter division, a unit within the Industrial Automation Group, had reached \$1.24 billion, which included \$608 million from PVT's 38% share of the \$1.6 billion US market.

PVT's five product groups were among the industry leaders. They offered integrated solutions across multiple market segments, including energy infrastructure and data centers/networks, as well as climate control for residential and commercial applications.

PV Technologies, Inc. – Revenue by Product Groups, 2010

Product Group	% of Revenues	Revenues (\$ Billions)
Industrial Automation	34	\$ 10.3 ^a
Process Management	24	\$ 7.2
Network Power	22	\$ 6.6
Drive Technology	12	\$ 3.6
Climate Technologies	<u>8</u>	<u>\$ 2.5</u>
	100	\$ 30.2

^a Includes photovoltaic inverter sales of \$1.24 billion, which equates to 4.1% of total revenue

PVT earned this market share and revenue growth primarily because of its R&D and reputation for product reliability and efficiency. PVT also benefited from its rapid response to and resolution of service-related matters and the efforts of Jim Salvatori, who was hired in 1993. He brought to PVT a strong industry reputation, a significant book of business, and sales skills that few in the business could match. Like many segments in the renewable energy industry, the solar segment was relationship-driven, particularly in utility scale and commercial applications, where 95% of sales were made directly by company salespeople networking with other vendors and making direct sales calls on customers and prospects.

Photovoltaic Solar Renewable Energy Market

Shrinking supply sources, rising energy costs of traditional fuels, periodically unstable oil markets, and increased environmental awareness prompted many governments to offer tax incentives and subsidies as a means of encouraging the development of renewable energy initiatives for new power sources. A second purpose was to accelerate the pace of conversions to alternative sources of energy, particularly within large-scale utility and industrial environments where photovoltaic technology was gaining acceptance as a viable source of electric power generation.

Despite a challenging economic environment in the United States, PV installations almost doubled to total 878MW in 2010 from the 477MW reported in 2009. The total market value was \$6 billion in 2010 compared with \$3.6 billion in 2009.² Additionally, the U.S. market for solar PV was forecasted to expand at a 30.4% CAGR during the period 2010–2015 reaching 1,906MW by the end of the period.³

Much of the growth of the PV industry in Germany, Spain, Italy, France, and Japan—as well as in a number of US states, including California, Arizona, and New Jersey—was driven by government subsidies. Additionally, the US federal government incented PV growth with favorable legislative measures including investment tax credit and Treasury programs. Given the federal government’s vision of reducing the dependence on fossil fuels by satisfying 80% of the country’s electricity demand from clean energy sources by 2035,⁴ industry observers expected the continuation of tax-based incentives.

Numerous states had also established policy initiatives to incent renewable energy development. That activity created a fragmented patchwork of legislation, but had been effective at stimulating local markets. Yet, solar energy still provided less than 1% of the world’s total energy compared with approximately 85% being derived from oil, natural gas, and coal.⁵

Buying and Selling PV Inverters

A PV inverter is a critical component in a photovoltaic system. It converts the direct current (DC) output of a solar panel into alternating current (AC) that is compatible with residential or commercial use and the utility grid power. PVT engineers designed and manufactured a variety of PV inverters for applications ranging from small residential projects to large scale commercial, industrial, and utility scale systems. (See **Exhibit 1** for example)

² Mindpower Solutions, *North America Solar Photovoltaic Market Outlook to 2015 – Evolving US Solar PV Industry*, September, 2011, pp. 29, 35.

³ <http://www.solarplaza.com/pressrelease/the-us-solar-pv-backsheet-market-industry-trends>

⁴ SBI Energy, *Global Solar Inverter Markets*, November 2011, p. 34.

⁵ <http://www.engineeringchallenges.org./ems/8996/9082.aspx>

The PV inverter market was composed of three segments: residential, commercial/industrial, and utility companies. Residential and commercial/industrial segments produce electricity which is, generally, consumed on-site. To reduce carbon footprints and the cost of energy, many homeowners and commercial property owners had installed solar panels to reduce the usage of the more costly utility-generated electricity.

In the case of utility company installations, however, the electricity produced with renewable sources was primarily intended to meet renewable-energy goals imposed by the states. For example, in 2011, California passed SB X 1-2, which required that 33% of electrical energy consumed be generated from renewable energy sources by the end of 2020.⁶

In 2010, utility companies comprised 27.6% of the market, commercial 42.4%, and residential 30.1%.⁷ The greatest market growth was in the utility scale segment. While the profit margin on these utility projects was less than residential and commercial projects, their scale and visibility attracted the largest and strongest in the industry.

Given that business development efforts were focused on building personal relationships, PVT maintained two distinct sales divisions—one dedicated to utility scale and commercial/industrial power plant developers and the other focused on regional and local distributors, installation companies, and retailers.

Integrated Marketing Communications (IMC)

PVT's sales success was driven largely by the nature and quality of the relationship a salesperson developed and maintained with the decision maker(s) in the firm. The sales force used trade journals and sales collateral materials to raise awareness of products, provide information on new products, and build image and reputation. Salespeople also used catalogs to identify specific products for new and existing customers, and showcased products at trade shows.

Solar Power International was by far the largest and best-attended trade show, with an estimated 21,000+ attendees in 2011.

PVT's website was used to (1) showcase product features and benefits, (2) inform the target audience about current developments in processes and technologies, (3) demonstrate, through streaming video, equipment installed at actual sites, and (4) provide a point of initial contact.

Factors Affecting Specifications of PV Central Inverters

The industry had not yet developed a set of standardized metrics to measure reliability and efficiency of PV inverters. As a result, manufacturers used performance measures that were not consistently defined or universally applied. While the International Electrotechnical Commission (IEC) had established a standard, IEC 62446, to define the minimum requirements for documenting, commissioning, and inspecting grid-connected PV systems in 2009, the industry in North America had not fully adopted that methodology.⁸

⁶ http://info.sen.ca.gov/pub/11-12/bill/sen/sb_0001-0050/sbx1_2_bill_20110201_introduced

⁷ Mindpower Solutions, *North America Solar Photovoltaic Market Outlook to 2015 – Evolving US Solar PV Industry*, September, 2011, pp. 29, 35.

⁸ <http://www.seawardsolar.com/stnandardizing-pv-system-documentation-and-verification>

By 2011, inverter efficiency and reliability, manufactured cost, and anticipated expense for operations and maintenance were typically among the factors that most strongly influenced a developer's choice of inverter. Developers recognized that the central inverter—which conditions (converts direct current to alternating current for use in a power grid), monitors, and optimizes the energy delivered by the PV array—was an especially important component in a PV solar installation. The central inverter was also the most failure-prone component in the system. The greatest challenge to inverter reliability, uptime, and power conversion efficiency was the harsh field environment and its dynamic operation. Hence, performance of the inverter significantly impacted the energy generated and the selection of an inverter manufacturer.

A recent consideration for manufacturers and developers was the entry of Chinese firms into the US market. While the equipment introduced thus far was of somewhat inferior quality and performance, the cost differential was significant. Some in the industry believed this signaled the approaching “commoditization” of PV inverters; others disagreed.

Solenergy's Vendor/Product Evaluation Program

Solenergy maintained a regularly scheduled, confidential vendor evaluation program to monitor the financial condition of companies it invited to bid on its major projects. Similarly, it conducted confidential evaluations of the products offered by these companies. Both programs were components of Solenergy's operational risk management policy. An update was required in conjunction with the issuance of an RFP. Evaluations for major projects were conducted by Greg Morgan, Solenergy's chief electrical engineer, who managed the updates of the three competitors for the Barstow project.

The confidential evaluation found that while PVT's products remained superior in terms of efficiency, reliability, and productivity, the bid prices of the competitors' products—especially BJ Solar's—were significantly lower than PVT's. This outcome surprised Morgan. He'd anticipated that PVT's product would be more expensive, as it had been historically, but didn't expect the spread to be as wide as it was. Morgan valued the long-time relationship with PVT and, in particular, with Salvatori. But Solenergy was committed to a renewed focus on expense control, and the upfront cost differential was significant. He reasoned that an enhanced maintenance schedule, coupled with a proactive quality control program designed to identify potential performance issues before they occurred, should compensate for the inferior performance characteristics of the less costly inverters. Further, while the enhanced oversight and expanded maintenance schedule would raise operating cost, the lower net ownership costs argued in favor of selecting the lowest-cost product.

PVT's Management Concerns

Rubenstein's memorandum explaining Salvatori's discoveries to the Executive Committee was received as he expected it would be—with disbelief, surprise, disappointment, and deep concern. Some members challenged the validity of the unconfirmed findings while others, familiar with evaluations routinely performed by PVT engineers on its competitors' products, challenged the methodology and reliability of the evaluation. Based on the tested superiority of PVT's utility scale central inverter line, they believed that Morgan had not evaluated sufficient data to define inverter specifications or performance characteristics completely or accurately. They were convinced that, had Morgan done so, he simply couldn't come to the conclusion he'd apparently reached.

All the members, though, shared a great concern about the probable effect that Solenergy's implied endorsement of SOMA Energy and BJ Solar products would have on PVT. Morgan was

influential in directing Solenergy's purchasing decisions and in shaping the judgments of his peers in a close-knit industry. This could have a negative impact on PVT if the results were released to a broader audience. Some members even believed that the solar segment might no longer be a viable market for PVT.

Rubenstein also presented four alternative responses that he and Salvatori had delineated as possible next steps. The Committee agreed that the two men should present their message to a group of senior executives for evaluation, adoption of the best alternative, and the development of an implementation plan.

PVT's Options

Armed with no additional news about Morgan's report, Rubenstein and Salvatori met the next day with the senior executives of PVT to present the four alternative courses of action:

1. Offer to extend the original warranty at internal cost from 10 to 20 years.
2. Offer a 99% uptime guarantee at no cost.
3. Accelerate the introduction of a new product, scheduled to release shortly, with higher capacity at 1.25MW and 98.5% efficiency.
4. Tactfully initiate a dialogue with Morgan to confirm the reported findings of the evaluation.

They included a product comparison based on Salvatori's best guess of what may have been in Morgan's report (**Exhibit 2**), a schedule of pricing and gross profit by product (**Exhibit 3**), and a forecast of the financial impact of the alternatives (**Exhibit 4**). The discussion with the executives is summarized below.

Alternative 1

In the first scenario, PVT would extend the product warranty to 20 years; Solenergy would contractually prepay the warranty premium annually at the rate of 18% of the purchase price of each inverter. PVT would perform warranty services as necessary throughout the year and submit an invoice monthly of actual internal cost for parts, labor, and service calls to Solenergy for its recordkeeping purposes. At year end, PVT would "true up" the prepayment and issue either a refund in the event of an overpayment or an invoice in the event of an underpayment.

Most of PVT's competitors provided an industry standard five-year unlimited-hour usage warranty that covered service, parts, and labor if the inverters were used in accordance with the published operational guidelines and maintenance schedule. PVT, on the other hand, offered a standard 10-year unlimited-hour usage warranty. PVT also offered an extended warranty. Written in 5-year increments at an additional cost, a condition of this extension option was that it must be exercised prior to the expiration of the standard warranty.

Those marketing and sales executives who were inclined to accept Solenergy's high acquisition cost evaluation favored Alternative 1 because they believed the economic value of this alternative would clearly offset any product cost-related shortcoming Morgan may have identified. These executives believed that performance couldn't be a credible issue given the long performance history of PVT's central inverters and excellent reputation for consistently successful leading-edge technology.

Finance, production, and engineering executives, on the other hand, argued that PVT already had a significant competitive advantage with its 10-year warranty (see **Exhibit 2**). The economic value of

that 5-year advantage to Solenergy should be more than enough to gain their confidence in PVT's product, so why expose the company to additional and unknown expense, not to mention future complications and potential impact on profitability when negotiating contracts with other firms?

Alternative 2

In this scenario, PVT would offer its 99% uptime guarantee for each inverter's in-service life (as determined by PVT) at no cost, believing it was unlikely that the competition would match the offer.

In an uptime guarantee program, if the inverter is not fully functional due to a mechanical failure (assuming it was properly maintained in conformity with the stated policies) for any portion of productive daylight hours, the system owner would be compensated for the value of the energy that would have been delivered to customers during the period the inverter was offline. The program incorporated a "deductible," whereby the first 44 hours of downtime were treated as a negative adjustment in the reimbursement calculation. The calculation: (hours of sunlight per day * days in the year - 44) * (the inverter failure rate). PVT and competitors customarily offered this program, like the extended warranty, on a fee basis. Since PVT intended to offer this coverage at no cost to Solenergy, PVT would also attach a maintenance contract to the offer to ensure the inverters were maintained as necessary and to provide the opportunity for regular onsite visual observations.

"Competitors would be foolish to risk matching it," said Salvatori, "because, regardless of what Morgan may believe, their product quality is not high enough."

Sales and marketing executives, moreover, believed the guarantee reinforced the quality, durability, and reliability of PVT's products and would reinforce its leadership status.

Finance and production executives, however, opposed this approach, noting that the cost in lost warranty revenues would negate most of the profit in the deal. They argued that the potential for much higher costs was significant if the frequency of product failure was higher, or repairs were more costly, than assumed. They also argued that extending such an offer could negatively impact future equipment purchase negotiations with Solenergy and other customers. Perhaps, they offered, a review of manufacturing costs could identify opportunities to price the product more competitively.

Alternative 3

In the third scenario, PVT would accelerate the introduction of the 1.25MW model that was in the final stages of testing. This new product utilized the next generation of power management and PVT engineers believed that, with its 98.5 percent efficiency rate and a service life that matched that of the 1.0 MW product, it would be the most efficient and reliable inverter on the market. In addition, the use of cost-saving, leading-edge manufacturing techniques would create even greater value by allowing PVT to price the new 1.25MW model much closer to its 1.0MW predecessor than would have otherwise been possible.

Strategic planning felt that this was the preferable way to gain the top spot in the competition. It would avoid compromising the current strategy and pricing approach. And the timing was fortunate; they believed that the introduction of the new inverter, scheduled for April 2012, could be moved up to mid-January 2012, by simply re-arranging the reliability/efficiency testing queue and modifying the testing routine, which would then meet Solenergy's product availability requirements for the Barstow project.

The sales force believed the next-generation inverter, while potentially inviting a new set of objections (the greater the capacity, the greater the negative impact of downtime), could be successfully sold to large users at the suggested net price of \$187,500 because utility projects were becoming larger.

Marketing and Public Relations also supported this approach. The new technology was what the market wanted for large-scale projects and would reinforce PVT's leadership position by being first to market—an advantage that might be leveraged for quite some time.

R&D believed that, given the new inverter's superiority, Morgan would value Solenergy's having the opportunity to be the first to employ the latest technology and the most robust management system. However, they were concerned that all of the potential operating malfunctions may not have been identified and worked out due to the compressed testing timeframe.

Finance and production executives echoed this concern with malfunctions and weren't convinced the offer would impress Solenergy. Indeed, some within the industry had recently argued that inverter technology evolution had reached the point where a lower-cost approach was feasible: coupling combinations of smaller inverters, such as those that were already available in the PVT product line, rather than shifting to a single large inverter.

Alternative 4

Rubenstein and Salvatori suggested that before any changes were made to product and market strategies, PVT should approach Morgan directly, sharing the information PVT had obtained about the reported evaluation. If Morgan confirmed what they'd heard, they could attempt to persuade him and Solenergy executives to share or even re-evaluate the criteria from which they drew their conclusions.

Some PVT executives believed that Morgan might perceive little differentiation in competing inverter products and that the lowest overall price was the most important criterion. Others thought he might be receptive to a conversation, particularly given his employer's relationship with PVT and his relationship with Salvatori. Still others pointed to the intense pride of authorship that Morgan had displayed in the past; they believed that if Morgan was convinced his interpretations were valid, it would be difficult to approach him directly and that only ill will might result from any attempt to challenge his findings.

Finance and production executives continued to be skeptical about the existence of Morgan's report: the alleged conclusions were sharply at odds with PVT's recent evaluations of the same competitive products. Even if one assumed the report existed, Solenergy's evaluation was suspect because it was conducted internally, not by an independent third party.

But Rubenstein pointed out that product quality, durability, and reliability were critical metrics of any PV system, for the developer and for customers that employ large-scale solar arrays. He said, "Morgan had no reason to go against us specifically or to skew the criteria; he's famously objective, almost to a fault, in his analyses." Salvatori agreed and believed there were valid reasons for questioning the conclusions. The issue was how.

Conclusion

Most PVT executives doubted that many of their customers or prospects would hear about the results unless a press release was published. If it were published, they were uncertain about the effect on central inverter sales or the reputation of PVT, at least in the short term.

On the other hand, some were convinced that if PVT executives did not question and overcome the findings in Morgan's evaluation before the vendor selection process was concluded, PVT's response to the RFP would likely be rejected. If that were to happen, it could signal the beginning of the end of PVT's status as the industry leader. The inferences drawn from an announcement by one of the best in the business, regardless of the merits of PVT's new product, would be very difficult to overcome, particularly in this cost-sensitive business environment.

Many PVT executives believed that the present problem would never have occurred if they had known of Morgan's evaluations sooner. Given that Solenergy was PVT's number one customer, shouldn't Salvatori have known about this evaluation instead of hearing about it indirectly and after the fact? Was there an ethical breach that warranted review? As the leader in the PV inverter market, shouldn't PVT be working with customers to develop new products that best meet their needs on both a short- and a long-term basis?

Some executives believed that PVT should review the current policy of testing equipment performance and specifications against competitors' offerings. They also urged that PVT reevaluate the needs of its business segments and key customers on a more frequent and regularly scheduled basis to mitigate the risk that a similar situation would occur in the future. Those who supported this policy believed that this work should be viewed as a long-term investment in PVT's future market position. Company engineers, however, were already over-committed, so a program like this would require additional hiring or outsourcing. Without an increase in service staff, PVT would run the risk of deterioration in service quality for current clients if resources were diverted to support the new product.

Had PVT rested on its laurels and fallen asleep at the switch? What actions should be taken next to confirm or challenge Solenergy's evaluation results, and what should PVT do to continue to lead the PV inverter market? Or should PVT simply not do anything?

Exhibit 1 A Utility Scale PV Inverter**Exhibit 2** Utility Grade Photovoltaic Central Inverters Comparative—Features and List Prices

Feature	SOMA Energy	BJ Solar	PV Technologies (PVT)	Minimum Standard
Nominal AC Output Power	1.0 MW	1.0 MW	1.0 MW	
Efficiency (%) ^a	96.5	95.0	97.5	95.0
Expected Service Life (Years)	12.5	10.7	13.2	10
List Price	\$170,000	\$160,000	\$180,000	
Warranty (Years)	5	5	10	

^a The rate at which an inverter converts solar energy captured by the solar panel array into alternating current (AC).

Exhibit 3 Utility Grade Photovoltaic Inverters Schedule—List Price and Gross Profit

Capacity	List Price	Cost of Sales ^a	Gross Profit	% of Sales
250kW	\$70,000	\$49,000	\$21,000	30.0
500kW	\$100,000	\$66,000	\$34,000	34.0
1.0MW	\$180,000	\$108,000	\$72,000	40.0
1.25MW	\$187,500	\$105,750	\$81,750	43.6

^a Direct labor, raw material, and variable manufacturing-related expenses

Exhibit 4 Alternative Proposals for the 100MW Barstow, California, PV Energy Project

1. Offer to extend the original warranty at internal costs from 10 to 20 years.
2. Offer a 99% uptime guarantee at no cost.
3. Accelerate the introduction of a new product with higher capacity at 1.25M and 98.5% efficiency.

	Current	Alternative 1	Alternative 2	Alternative 3
Total project revenue	\$18,000,000	\$18,000,000	\$18,000,000	
Total cost of sales	10,800,000	10,800,000	\$10,800,000	
Sales commission	<u>72,000</u>	<u>72,000</u>	<u>\$ 72,000</u>	
Gross profit	\$ 7,128,000	\$ 7,128,000	\$ 7,128,000	
Premium collected				
Years 11 - 20		\$ 3,240,000		
Warranty expense				
Years 11 - 20		<u>\$ 3,240,000</u>		
Net Profit		<u>\$ -</u>		
Guaranty expense			\$ 6,980,172	
Maintenance contract income			\$ 1,600,000	
Maintenance contract expense			\$ 1,450,000	
Total project revenue				\$15,000,000
Total cost of sales				\$ 8,460,000
Sales commission				<u>\$ 60,000</u>
Gross profit				<u>\$ 6,480,000</u>
Summary				
Total project revenue	\$18,000,000	\$18,000,000	\$18,000,000	\$15,000,000
Warranty premium		3,240,000		
Maintenance contract income			<u>1,600,000</u>	
Total revenue	\$18,000,000	\$21,240,000	\$19,600,000	\$15,000,000
Total cost of sales	10,800,000	10,800,000	10,800,000	8,460,000
Warranty expense		3,240,000		
Gross expense - guarantee			6,980,172	
Maintenance contract expense			1,450,000	
Sales commission	<u>72,000</u>	<u>72,000</u>	<u>72,000</u>	<u>60,000</u>
Project cost of sales	10,872,000	14,112,000	19,302,172	8,520,000
Project gross profit	<u>\$ 7,128,000</u>	<u>\$ 7,128,000</u>	<u>\$ 297,828</u>	<u>\$ 6,480,000</u>