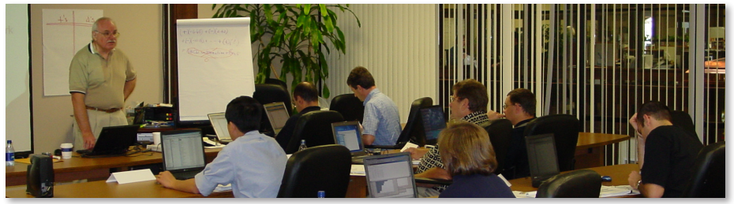
## ABOUT SBTI



**Value Proposition**

Recognized as thought leaders and innovators in business process improvements, Sigma Breakthrough Technologies Inc. (SBTI) is a global management consulting firm specializing in the deployment of Six Sigma and Lean methodologies. SBTI delivers innovative and sustainable business process excellence solutions by developing future leaders with core competencies to drive superior top and bottom line results. We advance our clients with best-in-class results in revenue growth, cost reduction, new product development and process improvement.

**What We Provide**

SBTI offers a full range of programs and services. These offerings include leadership workshops, asset maximization, strategic planning and assessments, multilevel managerial workshops and specialized "belt" training at the tactical level.

**Results. Guaranteed.**

SBTI delivers the fastest and highest return on investment in the industry. Always incorporating a measurement benchmark, most of our clients experience an average of 30X return on investment (ROI) within the first 24 months of engagement.

**Global Resources**

Throughout our history, SBTI has demonstrated a track record of quickly responding to clients' global needs. Our international offerings are handled through regional offices in Latin America, Europe and Asia. Materials are available in English, Spanish, Italian, French, German, Mandarin, Korean and Japanese. Others in process of being translated.

**Our History**

Dr. Stephen Zinkgraf, one of the original Six Sigma developers, founded SBTI in 1997. Beginning with two corporate clients, SBTI has grown to more than 70 global corporate deployments and more than 220 clients using SBTI methodology.

SBTI Executive Directors and Master Consultants have a minimum of 10 years industry experience – some 25 or more. Our international offices provide the same unmatched experience and capabilities as in the states, while offering local language and bilingual instructors. All of SBTI's consultants have lead multiple waves of training, completed numerous projects and continually mentor Black Belts.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## CASE STUDY

**Industry:** Residential Energy

**Client:** Solar Power Installer

**Event:** Design for Six Sigma

## 50 Words or Less


This study highlights the Quality Function Deployment (QFD) aspects of a Design for Six Sigma (DFSS) for a residential market segment entry project and how the use of these tools and methods helped a small company show a residential customer how quickly they would receive a return on their investment.


# Increasing Satisfaction of Residential Solar Installation by Providing Accurate Cost Predictions.

In prior commercial rooftop work, formal requests for quotation or proposal were issued and then either won or lost. No Voice of the Customer (VOC) or Voice of the Business (VOB) work was done, nor any QFD work. In this case, the installers were held to performance standards alone. To sell a solar power generation system to a residential homeowner, justification of the financial benefits needed to be detailed before proceeding.

### Voice of the Customer

Many questions existed in the VOC for help in understanding the design and the installation. QFD and DFSS tools played a vital role in the design of this service. Some VOC samples encountered during the first dialog with the residential customer were:

- Why should we "go solar"?
- How much will it cost?
- What is the payback period? SREC market pricing?
- Does it add or decrease home value?
- How much maintenance is required?
- Will it damage the roof?
- What will it look like when finished?

Each question represents a need for more information or for the physical system. Diagram 1 shows the Affinitization of the 30+ individual statements and questions into 5 distinct groups (titled in red).

| I want to maximize the system's value | | I want the system to look pleasing to the homeowner | I want to maximize the operating time of the system | |
|---|---|---|---|---|
| I want the highest return on my investment that I can get | I want to maximize the energy produced | | I want the system to last as long as possible through any weather | I want the system to be operational as soon as possible |
| What's the payback period? | Is there enough sunlight with the trees behind us? | Where will the array mount on the roof? | How much maintenance is involved? | Who has to get the permits? |
| What will it cost? | Is there enough sunlight in the winter? | What will it look like? | How long will the whole system last? | How long will the installation take? |
| How many installers will quote? | How much power can be generated? | Do any of our roofs face the right direction? | How long will the solar panels last? | How long do we wait for State approval? |
| How do we sell the extra energy generated? | How do we sell the extra energy generated? | Where do I mount it on the ground? | Does the roof require extra maintenance? | When can we begin? |
| What about rebates: State and Federal? | How many panels do we need? | Will you be able to see it from the front of the house? | Do we need to reinforce the roof? | |
| How does it change the home value? | Do any of our roofs face the right direction? | How does it change the home value? | Will ice/snow damage the system? | |
| How long will the whole system last? | How efficient is the DC/AC conversion? | Where will the inverters be mounted? | How can it be damaged by lightening? | |
| | | How much of the wiring will show? | Will hurricanes damage the system? | |
| | | Where will the wires be routed in the house/garage? | Will the roof leak? How will you mount everything? | |

*Diagram 1- VOC Affinitization Table*

### QFD Approach

With the voices well in hand, and validated through a short survey that provided weighting, filling out the House of Quality (HOQ) could then begin. Solution independent solar power system attributes were identified and listed along the top. For each, the direction of improvement was identified relative to increasing customer satisfaction. With the customer weighting and the interior filled in,


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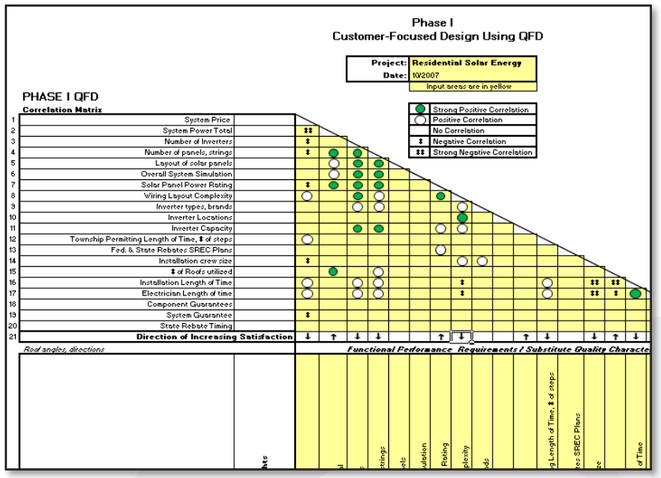


*Diagram 2 - The HOQ Roof*

the scores of the technical attributes could be graphed. By doing this, it became apparent that the top five technical items considered important for system design leading to customer satisfaction were:

1. Number of solar panels and wiring strings
2. Number of roof areas utilized
3. Overall solar power system simulation
4. Solar panel power rating
5. System Power Total

Diagram 2 illustrates the roof of the HOQ, showing areas of technical correlations, both positive and negative. Negative correlations highlight system technical areas that require trade-off to achieve multiple customer goals. The strongest technical trade-offs identified were:

- System Price versus System Power
- Installation Time versus # of roofs used and crew size

## Voice of the Business

The second focus is the Voice of the Business, which we will view from the homeowner's perspective. The focus is on the financial benefits of the solar power system versus the planned costs.

When a price proposal was delivered to the homeowner, it lacked sufficient detail in the payback of investment. This relates well to two pointers: first, that the installer was previously bidding to commercial installations where the customer would do the payback modeling and second, the customer was quoted in the Red Level Titled grouping as:

"I want to get the highest return on investment possible",
more specifically:

- What is the payback period?
- What will the total system cost?
- How will it change the home value?
- How do we sell the extra energy generated?
- What about the State and Federal Rebates?

The homeowner clearly wanted a very detailed and well-understood payback model from the outset. Diagram 3 shows payback in 7 years, assuming savings and SREC sales benefits of $4300 annually after $26,000 outlay. This scenario has an Internal Rate of Return on 11.5% and a Net Present Value of near zero.

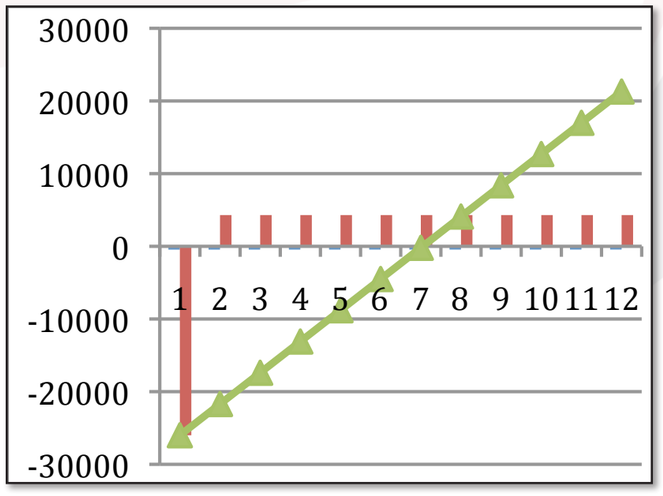


*Diagram 3 - Initial 3 roof concept payback model*

This initial payback model lacked a few key aspects: the cost of replacing the inverters, conservatively expected to last 5 years minimum (this changed the IRR to 7%), and the payback period extended out to 9 years, which was not to the customer's satisfaction.

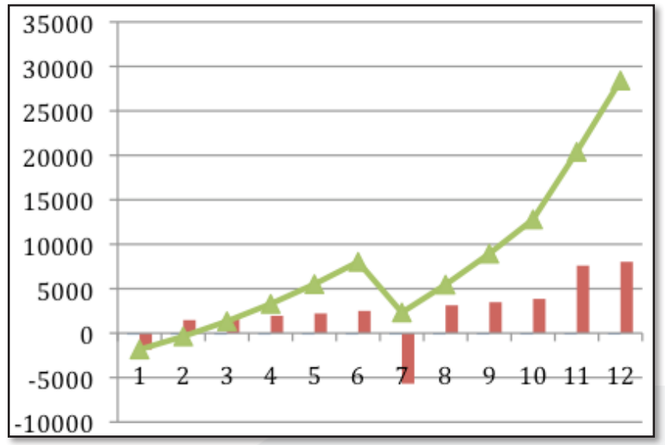


*Diagram 4 - Complex Payback model*

An updated model with the inverter replacement included is shown in Diagram 4. This also contains the cost of the loan payments, made over 10 years, a 7% annual electricity cost increase, and inverter replacement costs. This model also shows positive cash flows onward from year 3. The equivalent Net Present Value is well over $8000, the IRR is over 20%, and the payback is still positive in year 7, with an expected series of inverter replacements. These efforts and responses to Voice of the Business issues on financial matters assured the customer that these matters would be addressed and helped win the business for the service installer.

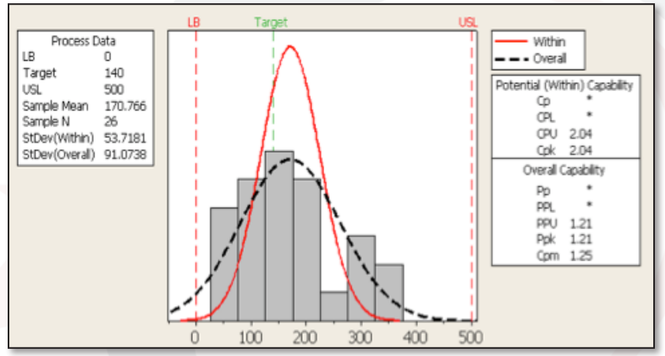


*Diagram 5 - Electricity Cost Capability Analysis*

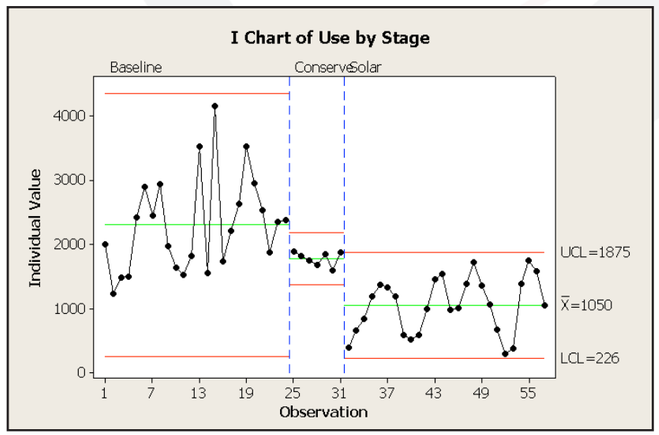


*Diagram 6 - Phase I and II consumption improvements*

## Conclusions and General Results

During this study, the net electric rates the consumer experienced rose by nearly 70% across 57 months of study. So while consumption was being decreased, the net effective rate to procure electricity was rapidly rising.

One key goal of the customer was to save money and "yield the highest return on investment" from the Red Level Titled VOC. Shown in Diagram 5, the final measurement of cost is in a capability analysis graph. While the average monthly cost is still not quite on the target of $140, it is close at $171 per month. Without the rapid increases to electricity rates, the target would have been exceeded. Diagram 6 shows the net reduction in overall usage including both conservation and with the solar system installed." This case study illustrates how a small service company can use QFD and DFSS to become more successful in a new market segment by focusing on the customer, which is always a key to success.