

RE-SHORING: TOTAL COST OF OWNERSHIP, A CONTRACT MANUFACTURING GUIDE

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ABSTRACT

Manufacturing overseas has come under scrutiny over the last few years due to:

- 2009 recession
- Debilitating U.S. budget deficit
- Near-record high U.S. unemployment rates
- In China and other developing countries,
 - o Questionable labor practices
 - o Wages have increased dramatically year over year
 - o Workers are striking
 - o Intellectual Property (IP) risks

These are all major concerns to the bottom line. These, and other issues, have put the validity of keeping manufacturing work offshore into question.

This paper/presentation will go through the use of the “Reshoring Initiative’s” Total Cost of Ownership (TCO) Estimator tool and analysis to make informed decisions about the true cost of offshore manufacturing.

Keywords: Reshoring, Onshoring, Offshoring, Total Cost of Ownership or TCO, Business Analysis Tool

INTRODUCTION

The definition of “Re-shoring” or “reshoring” is the act of moving manufacturing back to the U.S., opposite of “offshoring” or moving manufacturing overseas to low labor cost countries, which was happening at massive rates decades ago.

Other synonym terms used are “Onshoring”, “Backshoring”, “Homeshoring” or “Inshoring”. “Near-shoring” is another term for the act of moving production near the U.S., like Mexico.

This latest change in why production is being moved is prompted by the following:

- 2009 Recession and the lack of manufacturing jobs to support the economy
- Near-record high U.S. unemployment rates has pushed the government into action.
 - In 2009, U.S. unemployment hit a 26 year high of 10% and has been hovering between 8 & 10% ever since [1]. Last time the unemployment rate reached 10% was in the

1981-1982 recession, its highest level since World War II [2].

- Questionable labor practices overseas to build U.S. consumer goods.
 - Operators are being worked to the bone with long hours and hazardous conditions [5].
- Wage increases of 20% on average per year.
 - Harold L. Sirkin, a managing director at Boston Consulting Group, said, “At 58 cents an hour, bringing manufacturing back was impossible, but at \$3 to \$6 an hour, where wages are today in coastal China, all of a sudden the equation changes.” [3]
- Strikes have hit big name companies affecting their ability to deliver.
 - In November 2011, Apple and IBM were affected by strikes happening at a keyboard manufacturer [4]. Workers were protesting low pay as inflation was driving up the cost of living. Many provinces responded by boosting minimum wages. In January 2012, 300 Chinese workers building Xbox consoles for Foxconn went on strike for low pay and poor conditions [5].
- Intellectual Property is not secure overseas.
 - In April 2012, China was listed for the eighth year by the U.S. Trade Representative's office as a country with one of the worst records for preventing IP theft [6]. Even Apple stores have been counterfeited all over China [7].

RE-SHORING

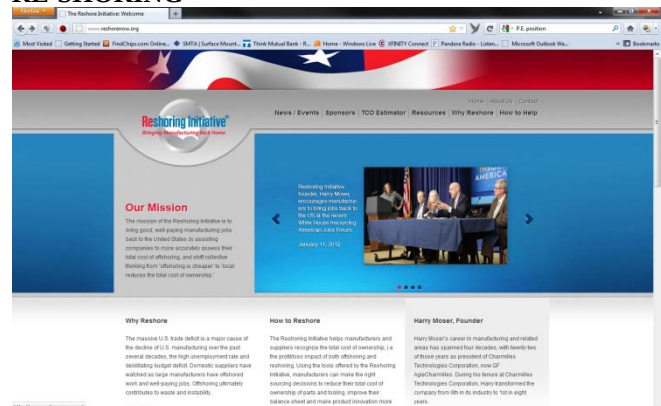


Figure 1. Reshorennow.org website [8]

“Reshoring Initiative” website (www.reshorennow.org), see figure 1, and organization was founded by Harry Moser, see picture figure 2, in 2010 with the help of NTMA, AME, AMT, SME and PMA to bring manufacturing jobs back to the U.S. by helping OEMs better understand the full cost of offshoring and the benefits of reshoring. Harry worked for GF AgieCharmilles, an EDM and HSM machine tools producer, starting as president in 1985 and retiring 2010 as Chairman Emeritus. He writes and speaks nationally on how to strengthen the skilled manufacturing workforce, strategies for competing with low cost countries, strategies for revitalizing U.S. manufacturing, and on the impact on manufacturing of President Obama's and Congress' actions and policies. [9]



Figure 2. Harry Moser, founder of Reshoring Initiative

He has been on FOX Business, CBS and Lean Nation radio, quoted in the Wall Street Journal and USA TODAY and in numerous articles in the industry and supply chain press and spoken at a broad range of conferences, including at the National Press Club. Harry is on the board of NIMS (credentials for skilled manufacturing) and is President of SMTS (Swiss Machine Tool Society). He received a BS in ME and an MS in Engineering at MIT and an MBA from U. of Chicago.

Harry has numerous quotes on his views of past offshoring of manufacturing:

- “Studies show that 60% of the companies that offshore their products fail to recognize 20% of the cost to doing manufacturing offshore.”
- “These companies most commonly overlook emergency airfreight, travel and the negative impact on innovation of separating manufacturing from engineering. These could account for 20 to 30% of the total cost of off shoring.”

Here is a list of companies and their products that they were reshoring over the last couple of years [10]:

- Electrolux Appliances from Canada to Memphis, TN
- Peerless-AV Audio/Video mounting from China to Aurora, IL

- Lightsaver Tech Emergency Lighting from China to San Clemente, CA
- Seesmart LED lighting from China to Simi Valley, CA
- Pigtronix Guitar Pedals from China to Port Jefferson, NY
- MasterLock Combination Locks from China to Milwaukee, WI
- Caterpillar Hydraulic excavators from Japan to Victoria, TX
- GE Water-heaters from China to Louisville, KY
- Ford:
 - o Hybrid transmission from Japan
 - o Battery pack from Mexico
 - o Steel forging from India
- Whirlpool Appliances from China to Greenville, OH

As quoted, reasons for moving onshore include:

- “Cost of IP protection too high”
- “Too much inventory in transit”
- “Reduction in lead-time”
- “More control of the processes & quality”
- “Faster product launch”
- “Communication was too difficult”
- “Daily meetings at 11 PM”
- “Engineering and Manufacturing on same floor”
- “Overseas wages/prices increasing every year”
- “Emergency air freight too common”
- “20-25% of employees did not return from annual holiday”

Now that we have good understanding on where Harry came from and his reshoring experiences, we can go into the tool he developed to ask the right questions whether reshoring or offshoring is most economical for Total Cost of Ownership.

TOTAL COST OF OWNERSHIP

Total Cost of Ownership definition:

- Total Cost of Ownership (or TCO) is the full cost to design, build, store, package, ship, sell, and maintain a product. This also assumes end-of-life material purchases and material discontinued expenses.

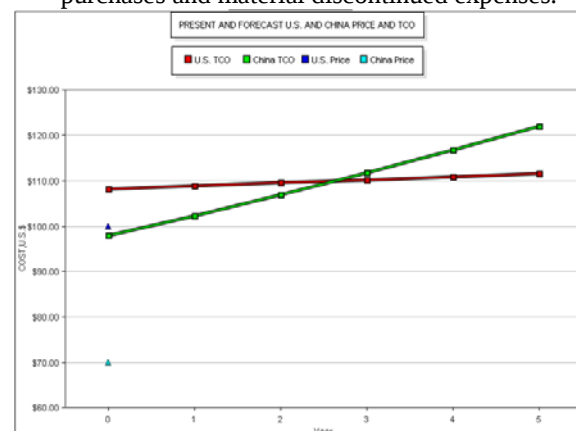


Figure 3. Present and Forecast U.S. and Offshore Price and TCO Example Chart

HISTORY OF THE TCO ESTIMATOR

The first tool was created by Harry Moser using Microsoft Excel. The tool was very easy to use and open to anyone to dissect. BTW, Inc. has an earlier version available upon request. The latest tool is now built into the website and is lacking some of the key formulas to the calculations. It still gives the same charts and graphs but requires a sign-on to the “reshorennow.org” website to get access.

ON-LINE TOOL FEATURES

The on-line tool allows for each scenario to be saved in your own profile. All fields are rather intuitive and have explanation next to them. When complete with each form, the on-line analysis gives a complete summary and graphs that can be used to show OEMs, or other customers, what makes sense.

STEPPING INTO THE TOOL LINE-BY-LINE

Input page for Total Cost of Ownership Estimator™

[View Example Form](#)

fields with a * are required

General Information

Name For Calculations:

*Is your data a real case or are you experimenting with the TCO Estimator? ☐ Real case ☐ Experimenting

*Which of the sources you are analyzing is currently a source and thus your data is based on experience not conjecture: (check one or both)

☐ U.S. ☐ Offshore

*Is or would the work being analyzed be produced:

-Offshore: ☐ In-house (in your own facility), or ☐ outsourced (sourced from a supplier)

-U.S.: ☐ In-house (in your own facility), or ☐ outsourced (sourced from a supplier)

Industry: - Select -

Product Description:

No.	Input data factor	U.S.	Offshore	Common	Explanation
1	*Country of Origin		- Select -		Country determines freight rates.
2	*Unit price, \$				For in-house production insert standard cost or Cost of Goods Sold.
3	*Units/year, quantity				
4	*Product category			- Select -	Product Category determines duty rate. The programmed duty rates for parts is 4% and for tools is 8%. If your products' duty rate is different from one of these: still select a product category, insert your duty rate in the cell in the next row.
5	Duty rate, if other than		%		For selecting a duty rate other than the default

Figure 4. Example TCO Estimator Tool Form

The initial steps are as follows:

1. Open web browser to <http://www.reshorennow.org>
2. Click on TCO Estimator at top of page
3. Click on “Account Login” or “Create New Account”
4. Once logged in, you should have “Completed Forms”, “My Case Studies”, and “Logout” links on the left of the page. Click on “Completed Forms”
5. Next you will click the “Add A New Form” link
6. Now you are in the form, see figure 5. Enter a name in the “Name For Calculations” field
7. Select “Real case” or “Experimenting” radio button
8. Check each box for source if you have experienced data to answer the questions – U.S and/or Offshore
9. Select the closest industry to yours
10. Type in a generic term for your product description

All of this information has now setup a database record for “Reshoring Initiative” to be able to use for its studies on reshoring.

HEART OF THE DATA ENTRY

Line Item #1: Country of Origin

Obviously, U.S. does not need to be selected but the tool needs to know which offshore country you are examining the rates of. You can pick from Brazil, China, France, Germany, Hong Kong, India or Indonesia just to name a few.

Line Item #2: Unit Price, USD

Enter in the unit price in the U.S. and offshore without any added fees for taxes, packaging or shipping. Make sure both numbers are in U.S. dollars. Example would be an electronic tooth brush in the US costs \$50 to manufacturer but in China it costs \$30. If the manufacturing cost you have includes packaging, estimate the packaging cost and subtract it from the unit cost; and use the packaging estimate for line item #12.

Line Item #3: Units/Year, Quantity

Enter in the unit quantity that is forecasted each year. If it changes each year, put in an average 3 to 5-year quantity to get a sense of what the TCO would be. It is not setup to handle different quantities each year at this point.

Line Item #4: Product Category

There are only 2 categories that can be selected. “Part” or “Tool, e.g. mold or die” are your choices. Pick one that matches what you are manufacturing.

Line Item #5: Duty Rate

If you have a duty rate already known for your product, by all means, place it in this field and it will override the default duty rate setup by the country and product category.

Line Item #6: Unit Weight, Lbs.

Enter in the unit weight without packaging but including any accessories that the product will be packed with in U.S. pounds. If you have the unit weight including packaging, estimate the packaging weight and subtract it from the total weight; and use the packaging estimate for line item #7.

Line Item #7: Unit Weight, Packaging, Lbs.

Enter in the packaging weight depending on each country of origin. This is an average of a pallet/container of product weight divided by the number of products on the pallet/container. Typically the packaging required to ship from overseas to the U.S. is higher in weight to sustain the product through transport and the materials/type used may be controlled by each government both origin and destination.

Line Item #8: Shipments/Year

Enter in the number of shipments expected in a year for U.S. and overseas. Typically overseas will be less so that there is enough to fill an overseas shipping container to maximize space and reduce the cost of shipping per unit. This will require some careful planning to get the shipment quantity to meet demand or having to overbuild product to stock more in the U.S. to handle fluctuations in demand.

Line Item #9: Shipment Planned for Surface Freight, %

This is used to estimate the amount of shipments that will be scheduled for surface shipments via truck, boat or train. This may require some estimating if don't know already or it should just be set to 100% default.

Line Item #10: Product Life, Years

Enter in the product expected life per your sales forecast. Typical product life is 5 years. The longer this is, the higher the cost of maintaining and storing product.

Line Item #11: Supplier Relationship Life, Years

This would be the amount of time expected to be doing business with the U.S. or overseas supplier. This would hopefully line up with the product life per your sales forecast at a minimum.

Line Item #12: Packaging, % of Price

Enter in the percent of packaging cost in relation to product unit price depending on each country of origin. This is an average of a pallet/container of product cost divided by the number of products on the pallet/container. Typically the packaging required to ship from overseas to the U.S. is higher in cost to sustain the product through transport and the materials/type used may be controlled by each government both origin and destination.

Line Item #13: Lag from Shipment Date Until Actual Payment Date, Months

Overseas suppliers commonly require to be paid prior to shipment and may even require a down payment before starting the order. Place a "0" for the overseas supplier if this is the case. Most U.S. suppliers will allow a delay from shipment to payment (i.e. NET 30 or 60 days).

Line Item #14: Shipment Time, Months

This will show the huge discrepancy in time it takes to ship from a U.S. supplier versus overseas supplier. If less than a month for a U.S. supplier, put in a decimal equivalent of the time.

Line Item #15: Annual Carrying Cost, in Transit, % of Price

For this field, you only need to enter in a value if you have to pay for the product prior to shipment. This would be total cost of the product that was in transit during the year divided by the number of products sold. This number will be converted to a percent of the unit cost.

Line Item #16: Annual Carrying Cost, in Warehouse, % of Price

According to the tool, most articles suggest 25% of the unit price is in warehouse storage per year. I am not sure of the source. If you know the carrying cost of your product, calculate down to per unit cost and convert it to a % of the price.

Line Item #17: % of Shipments That Can Be Delivered Directly to the Floor JIT

This again will show the disparity between U.S. and overseas shipments. Typically, offshored shipments need to be large to allow for fluctuations in demand which the U.S. companies can handle in a Just-In-Time (JIT) supply structure.

Line Item #18: Cost to Place and Pick in Local Warehouses, % of U.S. Price

This is for U.S. warehouse transfers and needs be the average cost to move products around locally. Again this must be calculated to the best of your knowledge.

Line Item #19: Delivery Time From Order to Receipt, Months

This delivery time is from order to receipt of shipment and is different that line item #14 since it is first request to receipt versus #14 is for time off of suppliers dock to your dock.

Line Item #20: Quality, Rework, Warranty, % of Price

This is the cost of quality, rework, and warranty as it relates to percent of product price. Typically the offshore product will have higher quality issues than its U.S. counterparts.

Line Item #21: Product Air Freight to Meet Unforecast Demand or Overcome Quality/Delivery Issues, % of Product Shipped

This again sounds familiar to line item #9. This is used to estimate the amount of shipments that will require unscheduled emergency air shipment to relieve demand or to deal with quality issues of the stock in the U.S. This will require an assumption that this will happen if you have not experienced it already. Example defaults to 5%. One article states that there is a "quality fade" happening with oversea suppliers. This means that the supplier tries any way possible to cut corners on the product being built knowing full well that the customer may not even find the lower quality materials being used and that it is too costly to change suppliers at a moment's notice if they did find a problem [11].

Line Item #22: Opportunity Cost Due to Delivery and Quality: Lost Orders, Slow Response, Lost Customers, % of Price

Again this requires some estimating on what % of price could be lost by having quality in relation to the amount of quality issues expected in the country of origin.

Line Item #23: Unrecoverable Product Liability, Expected % of Price

This is truly a pull from the thin air estimate to figure out what product could be lost in shipment as relates to product price.

Line Item #24: IP Risk, Expected % of Price

This again is truly a pull from the thin air estimate to figure out what part of sales is lost due to stealing of Intellectual Property to create knockoffs as relates to product price.

Line Item #25: Supplier Economic Instability Risk, % of Price

If you have a full understanding of the overseas company you are doing business with, you may have the ability to calculate a potential loss of you supplier due to economic consideration.

Line Item #26: Country Political Instability Risk, % of Price

This falls into a similar bucket as the previous line item. If the government locks down the shipments, you may be out of luck to get your product. Environmental stability, as in an earthquake or flood, is not covered in this tool but this line can cover it as necessary.

Line Item #27: Innovation Loss, Expected % of Price

This should show that having the local presence of your manufacturing will allow for quick changes of the design or new products to be launched sooner. In order for the tool to use this, a percent of the price is needed to show the product being hampered by the slow changes. Default example is 0.5%.

Line Item #28: Trips to the Supplier/Year

This is a simple number of times per year required to audit the supplier.

Line Item #29: Cost/Trip: Travel, \$

Estimated average total cost to travel to the supplier for each trip not including salary of employee.

Line Item #30: Cost/Trip: Time, Including Fringes, \$

Here is where we include the salary of the employee and the fringe time to be able to get them to be productive again after the trip.

Line Item #31: Pre-evaluation Regulatory Compliance Cost, 1X, \$

This is the total cost it takes to travel to multiple suppliers to check them out and later select one to audit.

Line Item #32: Purchasing Cost, Other Than Travel, % of Price

This is the cost to purchase the product from the suppliers given the currency differences and communication barriers.

Line Item #33: Prototype Cost

This is typically the difference between U.S. getting the business after prototyping (partnering) versus offshoring once prototypes are complete. The U.S. company will charge a higher amount to cover all costs versus waiting for the volume of production to make-up for the expense.

Line Item #34: Impact on Product Differentiation/Mass Customization, % of Price

This is the lack of ability to have customizable product overseas. Again an estimate on how much it affects the product by not being able to change something as little as updated software or USB cable length. Also, the same with allowing changes from prototypes and NPI to true stable volume production.

Line Item #35: Wage Inflation, Forecast, Annual %

Enter in the estimated wage inflation of each country in percent. Typical is 2% for U.S inflation. Overseas inflation could be anything from 5 to 20% depending on the area.

Line Item #36: Currency Appreciation, vs. \$, Forecast, Annual %

Enter in the estimated currency appreciation over the U.S. dollar in percent. There are forecast tools out there that can help with this. Do a little GOOGLE searching.

TCO ANALYSIS

Total Cost of Ownership Estimator™ Results			
Example			
Modify Inputs			
Cost Factor	U.S.	China	Calculation Formula
CoGS (Cost of Goods Sold)			
FOB price	\$100.00	\$70.00	
Packaging	\$1.00	\$1.40	unit price x packaging cost %
Duty	\$0.00	\$2.80	duty % x price
Fees: % of price	\$0.00	\$0.50	fee % x price
Fees: flat	\$0.00	\$0.10	fee
Routine surface freight, excluding local	\$0.00	\$0.29	% routinely planned for surface freight x (unit weight + packaging weight) X surface freight rate
Routine air freight, excluding local	\$0.00	\$0.00	(1- % routinely planned for surface freight) x (unit weight + packaging weight) X air freight rate
Freight insurance at 0.5% on imported product	\$0.00	\$0.35	
Total CoGS	\$101.00	\$75.44	
Other Hard Costs			
Carrying cost for intransit offshored product if paid before shipment	\$0.00	\$0.47	shipment time in years X interest rate X price
Carrying cost for inventory on-site	\$0.82	\$2.57	unit price X (avg. cycle inventory mos. + safety stock mos. + buffer stock mos.) / 12 X carrying cost %
Prototype cost	\$0.03	\$0.12	prototype cost/annual units/product life
End-of-life inventory	\$2.41	\$5.83	1/12 x unit price x (Delivery time + avg. inventory) x annual quantity/annual quantity/product life
Travel: start-up	\$0.02	\$0.17	start-up cost / annual units / vendor life
Travel: audit/maintain	\$0.08	\$1.57	annual # of trips X (per trip cost of travel time + expense) / annual units
Pick/place into local inventory	\$0.00	\$2.00	(1- % of inventory delivered JIT) x U.S. unit price x pick and place cost as % of U.S. unit price
Purchasing cost, excluding travel	\$2.00	\$3.00	U.S. unit price x purchase cost %
Total Other Hard Costs	\$5.37	\$15.72	

Figure 5. Example TCO Estimator Tool \$\$ Results

At the bottom of the input field page, there are 2 buttons for “Save” and “Complete and View Results”. “Save” will store it in your history and the other button will show the results as well as saving it for future use.

The results will regurgitate all the fields you filled out with U.S. dollars to breakout where all the values came to (see figure 5). Next to each row, there is a formula that was used for the dollar value result. If any do not seem right, you have the ability to modify the inputs with the link at the top of the results, “Modify Inputs”.

If you have any additional charges that the tool does not account for, there is a “Green” section for some standard

charges and a few “Other Costs” fields that allow for these charges to be added. Once entered, click on the “Submit Changes” button to update the charts at the bottom of the results page.

Figure 6 is a chart showing initial unit price and Total Cost of Ownership over 5 years. In this case, it shows that in the third year, the TCO for offshore manufacturing exceeds the TCO for U.S. manufacturing. U.S. manufacturing is rather stable in comparison over 5 years.

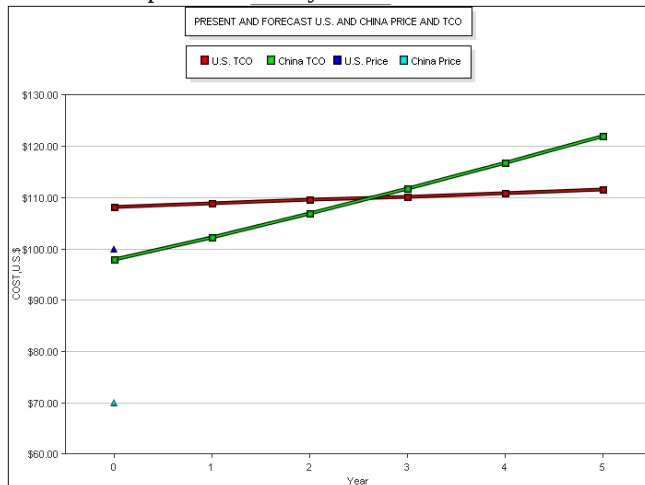


Figure 6. Example TCO Estimator Results Chart for Present & Forecast Price & TCO

Figure 7 shows the cumulative sum of all the expenses in Year 0. As you can see, PRICE on the left shows the biggest disparity and gradually the cost gap closes as you include the other costs not in the price of the product. In most cases, the U.S. line changes much less from the initial price unlike the other country's cumulative line.

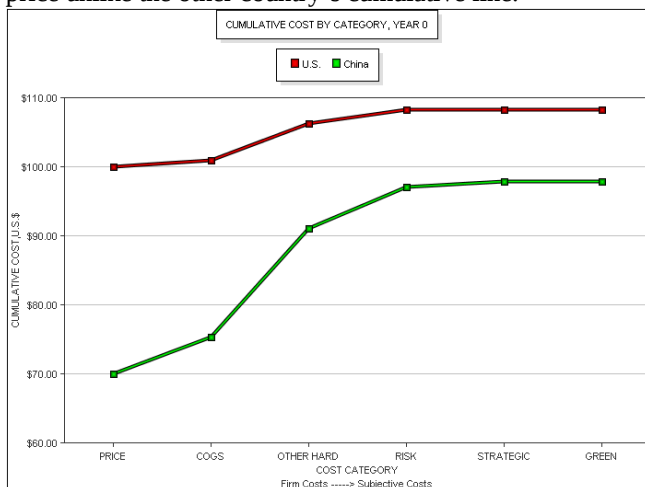


Figure 7. Example TCO Estimator Results Chart for Cumulative Present Cost

WHAT THE TOOL DOES NOT ACCOUNT FOR

The tool does not show the other potential issues with overseas suppliers. Below is a list of these items:

- Hefty minimum order quantities
- Quality issues during startup

- Preparing paperwork for shipments which all requires domestic staff. This paperwork would include:
 - Commercial Invoice
 - Packing List
 - Detail Sheet
 - Bill of Lading
- Finding a good Customs Agent at a cost
- Comprehensive, legal contracts for all transactions must be signed with overseas suppliers to lock in the details. Trust factor is always a concern when dealing with overseas suppliers.
- Import license may be needed.

CONCLUSION

Reshoring is occurring now and the Total Cost of Ownership is at the forefront of this movement. This tool helps to make a hard decision easier and reduces the chances of missing the hidden costs associated with manufacturing offshore.

If you are doing business offshore, use this tool today to see if it makes sense to continue with the current product or even for a new revision. **Bring manufacturing back to the U.S.A.!**

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