Define the Problem

- ❑ What is the need?

Examples:

The device needs to be heated in cold weather in order to work properly.

OR

The process needs to be heated to 37°C for the analysis to be accurate.

OR

To maximize our product/ process yields the temperature must be stabilized.

Research

- ❑ Goggle search key words such as foil heaters, heating solutions, ...
- ❑ Heat transfer theory. Check out potential supplier web sites for design tools.
- ❑ What can suppliers perform for value add. Do they supply sensing, flexible circuits, and heating solutions? Assembly? Do they perform FEA?
- ❑ What are the various solution types available for your unique problem.
- ❑ What are the cost impacts of the identified solutions

Develop Numerous Solutions

- ❑ Gather cross functional team to review research
- ❑ Brainstorm potential solutions to your problem. The more ideas proposed the higher the probability of success.
- ❑ Hand sketch ideas at this stage.
- ❑ Rough calculate the heat energy requirements.
- ❑ Determine future needs, as some suppliers are tooled up for only certain production volumes.
- ❑ Obtain samples from suppliers to play with. This will help with generating ideas.
- ❑ Short list the potential suppliers and solutions
- ❑ Determine solution “must haves” and “nice to haves” requirements

Select Best Solution

- ❑ Contact potential suppliers and qualify solutions.
- ❑ Refine potential solutions with supplier input.
- ❑ Generate a drawing of the ideas sketched.
- ❑ Continue to develop solution requirements.
- ❑ Finalize on best fit solutions.
- ❑ Short list potential suppliers of best fit solutions

Pre-Prototype Stage (Build Concept Model)

- ❑ Build a paper model of potential solutions
- ❑ Build or obtain a form fit model from potential suppliers. This model might consist of a stack-up of the actual materials cut to size.
- ❑ Continue conversations with suppliers so that GMP can be factored into the design. The suppliers should provide feedback on your concept model at this stage.
- ❑ Theoretical and or experimental testing should occur at this stage.
- ❑ Buy off the shelf parts to experimentally test the concept model
- ❑ Design 3D CAD model of the heater assembly.

Build Prototypes

- ❑ The quality of the previous process stage impacts the speed at which prototypes can be designed and built by the supplier.
- ❑ Finalize electrical and mechanical requirements
- ❑ Add details from the concept model stage to drawing and specification
- ❑ Finalize supplier choices
- ❑ Determine if prototypes need to be ordered from multiple suppliers
- ❑ Order functional prototypes

Test, Qualification, and Revision

- ❑ Test and evaluate prototypes.
- ❑ Validate your expectations of the chosen solution.
- ❑ Determine any functional improvements.
- ❑ Determine any cost improvements (work with your supplier to lower costs)
- ❑ RFQ on production volumes. Firm pricing should be available after prototypes have been built.
- ❑ Determine is design, quality, function of your product is enhanced by a particular suppliers solution.
- ❑ Finalize supplier

Begin Production

- ❑ Implement improvements identified during prototype stage.
- ❑ Finalize design
- ❑ Finalize specification

Post Project Analysis

- ❑ Bring supplier into this discussion.
- ❑ What things still need to be improved in the design.
- ❑ Determine what things could have gone more smoothly during the design process.
- ❑ What knowledge gained can be applied to the next project.