Extended User Guide

Filters

Here is further explanation of each filter and their capabilities.

Suggestion Title

This filter allows users to input any keyword or words into a search box, and the tool will return all suggestions with that input in the title. This allows the user to come in with a process, part, or other aspect of a possible recommendation in mind to search over without being limited to a specific industry or method. Here is how the filter appears in the tool:

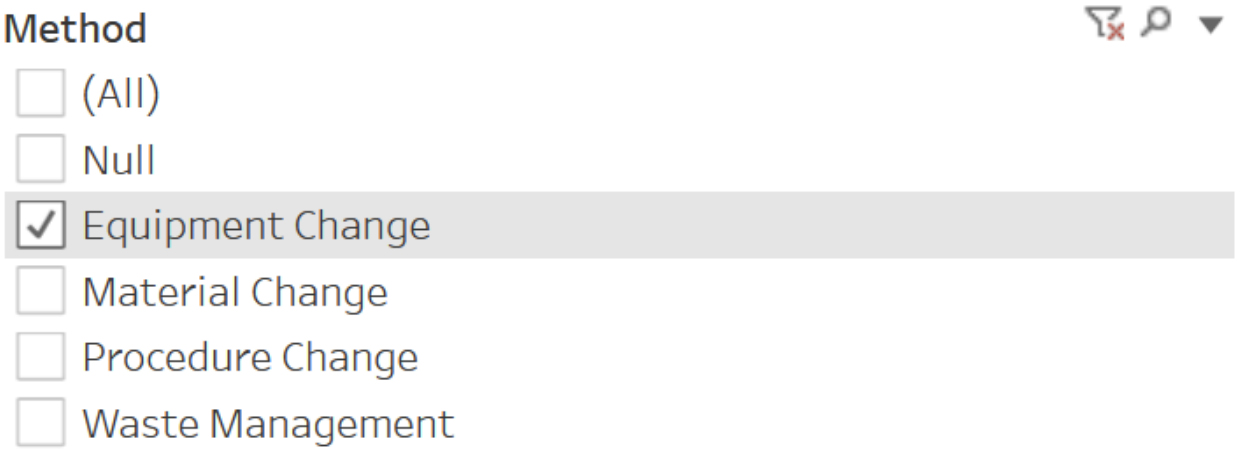
After a user enters a keyword, only those suggestions with that keyword in the Suggestion Title will appear.

Method

This filter allows users to only see suggestions categorized into a certain method of implementation, whether that be an equipment change, material change, process change, or waste management change. These come in the form of checkboxes, which users can select any number of when using the filter. Users can also choose to include or exclude null values, or values which

were not categorized in our database and therefore show up as null in this field. Here is how the filter appears in the tool with every option selected:

Selecting the (All) checkbox when everything is selected, such as above, will deselect all options and allow users to select a subset of the available options. Here is the result of selecting only the equipment change option:

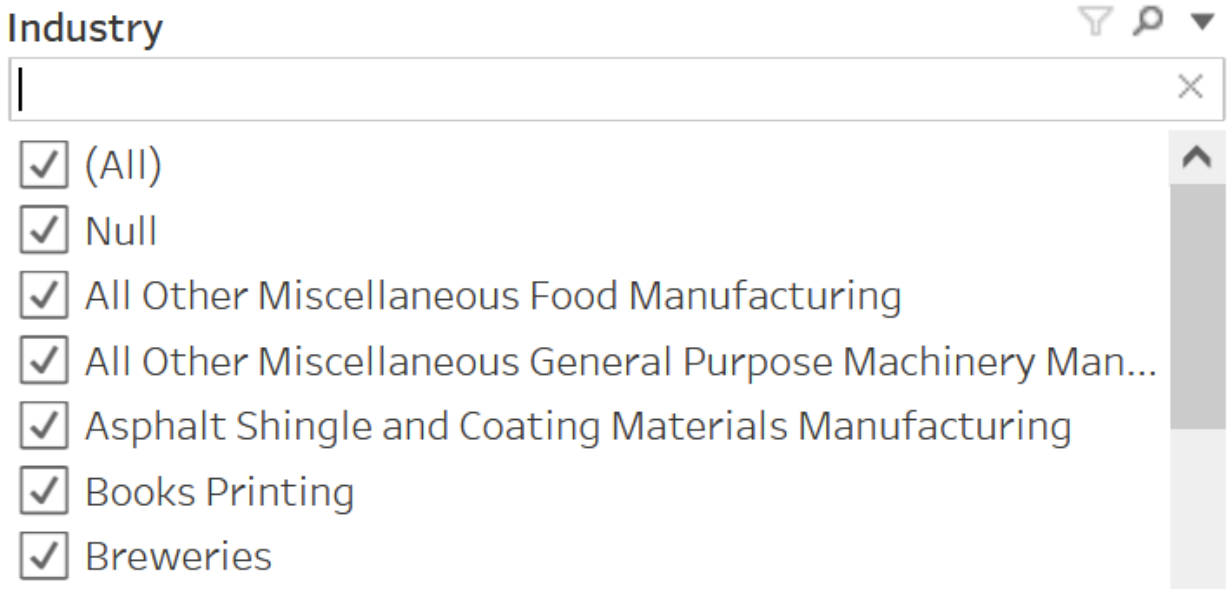


Suggestion Title	Method	Industry	Executive Su..	Actual Savi..	Proposed S.
Install auto fill valves on pump tanks	Equipment Change	Dried and Dehydrated ..	Null	$18,000.00	$18,000.00
Install Metering Valves on Lines 1-5	Equipment Change	All Other Miscellaneous G..	Null	N.I.	$3,100.00
Install solenoid valve and interlocking mechanism on line 6	Equipment Change	All Other Miscellaneous G..	Null	N.I.	$350.00
Install solenoid valve and interlocking mechanism on lines 1-5 water pipes	Equipment Change	All Other Miscellaneous G..	Null	N.I.	$2,000.00

Industry

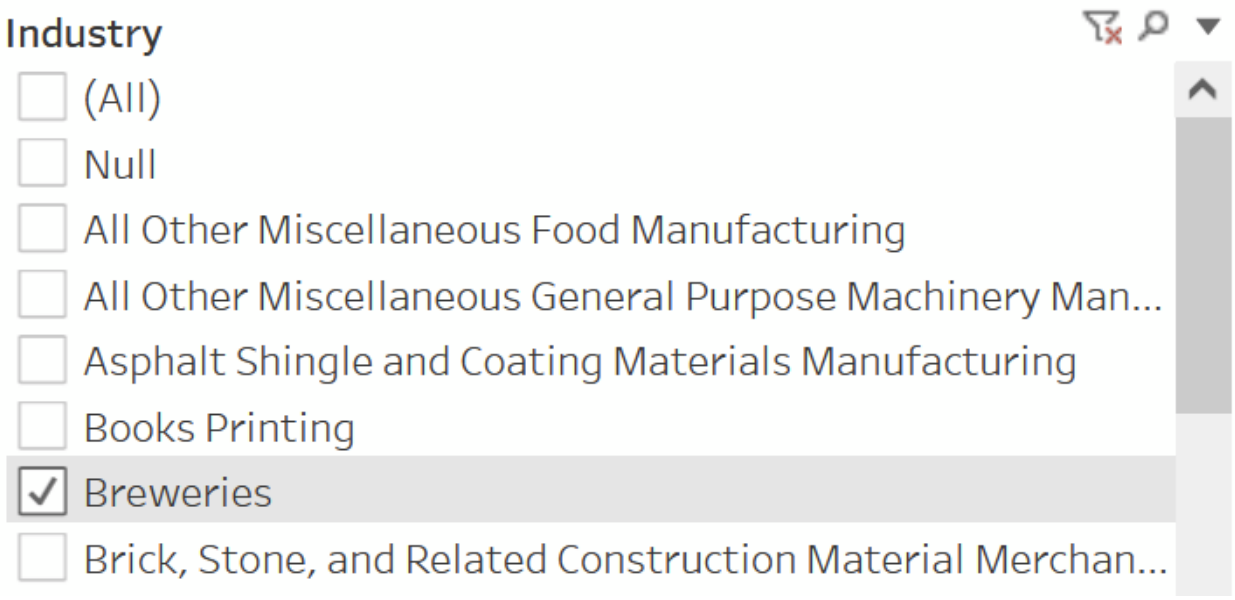
This filter allows users to see only suggestions made in certain industries. It is also a checkbox filter, and operates similarly to the Method filter. The industries included represent the industries of companies where the included suggestions were made. Industries not included are simply not there because no MnTAP Intern Project has taken place at a company of that industry. The names of these industries come from the official NAICS code names of these companies. Here is how the filter appears in the tool with all industries selected:

In the upper right corner of the filter is a magnifying glass, users can click here to open a search box which can be filled with the industry name the user is interested in. This will then pull up the industries which fit this name, and then those industries can be selected from the checkboxes. Here is the tool after clicking the magnifying glass:



And here is what the filter looks like after deselecting the other options and searching for "Breweries":

Click the X on the right of the search bar to show the rest of the options again:



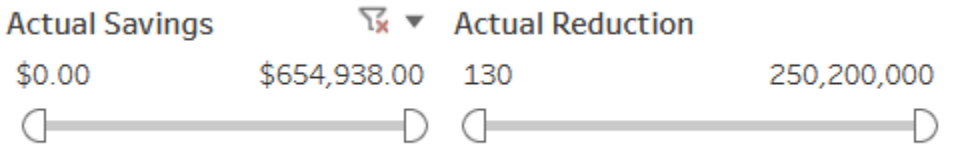
And here are the results of selecting just "Breweries":

Suggestion Title	Method	Industry	Executive Su..	Actual Savi..	Proposed S..	Proposed Cost
Canning line Water Reuse	Equipment Change	Breweries	http://www...	$1,500.00	$1,500.00	$150.00
Evaporate Yeast & Trub	Equipment Change	Breweries	http://www...	N.I.	$180.00	Null
					$9,020.00	$50,000.00
Flatjet Nozzles on Kettle	Equipment Change	Breweries	http://www...	N.I.	$400.00	$2,900.00
Insulation for Boiler Head Plates	Equipment Change	Breweries	http://www...	N.I.	$1,000.00	$2,400.00

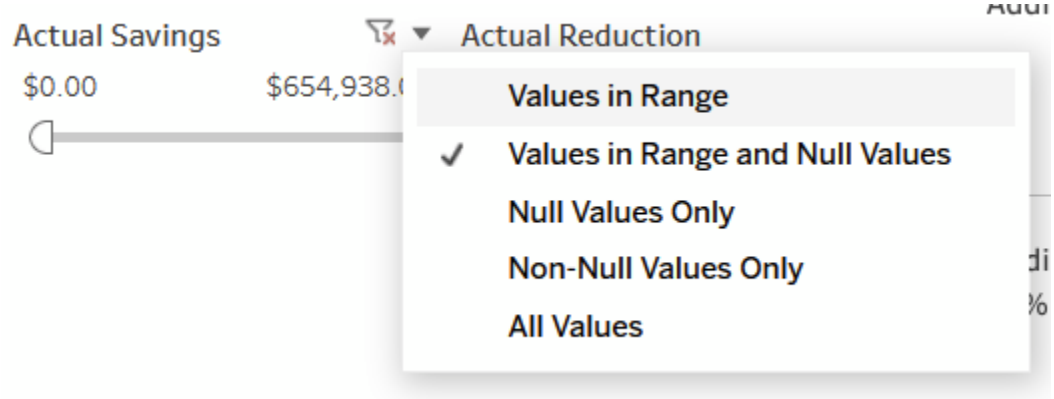
Actual Savings and Reductions

These sliding range filters allow users to only see suggestions which saved US dollars or gallons within a certain range. These filters are very similar in operation and function, so both are described here. These numbers represent the actual savings or actual reduction as reported by the company implementing the recommendation, and may differ from the proposed savings or reduction as calculated during the project if a certain suggestion were fully implemented. These filters also allow users to exclude null values. Null values for this value occur when the company does not get back to us about the savings of the suggestion, or when the suggestion was not implemented. The suggestion may still be useful in another situation, but for this instance of the

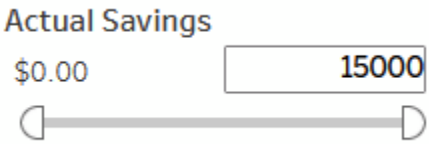
recommendation it was possibly not feasible. Null values show up as N.I., short for Not Implemented, in the tool. Here is how the filters appear with the full range of values selected:



Selecting the drop-down arrow in the top right of either filter (appears on hover for each) allows users to select whether or not to include null values. Here is how that appears:



The values for the range can be more specifically selected by clicking on the numbers on either end of the range:



Here is how the filter looks after choosing the range of savings to be between $500 and $15,000 and choosing the “Values in Range” option, which removes null values:

And here are the results of choosing this range:

Suggestion Title	Method	Industry	Executive Su..	Actual Savi..	Proposed S..	Proposed Cost
Add faucet aerators at high-use coffee break stations	Equipment Change	Electromedical and Electr..	http://www...	$700.00	$700.00	Null
add larger holding tank to prevent overflow	Equipment Change	Asphalt Shingle and ..	http://www...	$13,600.00	$13,600.00	$100,000.00
Adding aerators to sinks - first 30%	Equipment Change	General Medical and Surgical Hospitals	http://www...	$2,400.00	$2,400.00	Null
				$9,000.00	$9,000.00	$2,250.00
Adding aerators to sinks - second 30%	Equipment Change	General Medical and Surgical Hospitals	http://www...	$2,400.00	$2,400.00	Null
				$9,000.00	$9,000.00	$2,250.00
Airfin coolers replace cooling water on 4 condensate pumps	Null	Other Animal Food Manuf..	http://www...	$12,500.00	$12,500.00	$39,800.00

Results / Data

Suggestion Title	Method	Industry	Executive Su..	Actual Savi..	Proposed S..	Proposed Cost	Actual Reduction	Proposed Red..	Percentage of Possible Sa..
Canning line Water Reuse	Equipment Change	Breweries	http://www...	$1,500.00	$1,500.00	$150.00	150000 gals	150000 gals	100

Here is a description of each of the data points available in the tool, in order of how they appear in the tool from left to right:

- **Suggestion Title**: The title of the suggestion. Describes in the least amount of terms what the suggestion involved, usually whatever part or process was involved.

Suggestion Title
Canning line Water Reuse

- **Method**: The method of the suggestion. Either Equipment Change, Material Change, Procedure Change, Waste Management, or Null. Describes broadly what category each suggestion falls into in terms of what about a process needed to change to implement the suggestion.

Method
Equipment Change

- **Industry**: The industry of the company the suggestion was made at. Includes every industry which has had a MnTAP Intern Project that is included in this dataset. Name is taken from the abbreviated NAICS name for that industry.

Industry
Breweries

- **Executive Summary**: Clickable link to the executive summary associated with the MnTAP Intern Project the suggestion was made under. Gives a detailed description of what was involved in the project and is downloaded from the MnTAP website. Some projects are too old to have executive summaries produced and are therefore null.

Executive Su..
http://www...

Here is the pdf[1] of the executive summary for this particular suggestion:

Fulton Beer Company

Karl Wuolo-Journey,
Chemical Engineering,
University of Minnesota, Twin Cities

Company Background

Fulton Beer started out as a local homebrew operation in a south Minneapolis garage in 2006, then was formally founded in 2009. In less than a year, Fulton beer was in over 100 bars in the Twin Cities. In 2011, Fulton built Minneapolis' first taproom/brewery at their 20 bbl production facility. Within two years, Fulton had maxed their taproom's production capacity, so they purchased a building in NE Minneapolis and retrofitted it into an 80 bbl production facility. Currently, Fulton has reached production capacity of 33,000 bbl/year brewing five beers year round with another 26 seasonally. Their distribution spans throughout the Midwest and plans to reach the east coast within several years.

"Working with Fulton Beer Company was a great and educational experience. It was great learning about the brewing process and how to make it more sustainable. This experience has greatly furthered my skills as an engineering student, and my ability to approach a problem critically to come up with creative solutions. I am gratefull to MnTAP for giving me the opportunity to apply my engineering skills in the field and I'm confident that the experience I gained will be an asset throughout my career." - KWJ

Project Background

Fulton uses water supplied by the city of Minneapolis. This water is dechlorinated to prevent degradation of their stainless-steel brewing equipment and then used in for beer production, floor, tank, and packaging rinses, and lubrication for conveyor lines. Fulton is aware of their high water usage and has manufactured equipment to help reduce their consumption. This includes several process lines that recycle used cooling water into their hot liquor tank. In addition, Fulton has made efforts to minimize and recycle their rinse water. Fulton has also built a basic pretreatment system to remove solids and neutralize the pH of their high strength effluent. Although they have implemented several means to reduce their recourse consumption, there was still much room for improvement.

Incentives To Change

The brewing industry is a highly water intensive process. A craft brewer can use anywhere between four and nine gallons of water to produce a single gallon of packaged beer. Much of this water is heated water, making the process even more energy intensive. Fulton will likely use over 5,000,000 gallons this year. In addition, the brewing industry produces a lot of high strength wastewater. This water contains high levels of organics and solids, such as yeast, spent grain, and alcohol which contribute to the total suspended solids (TSS) and chemical oxygen demand (COD) of the effluent. This water is expensive to treat. As such, the Metropolitan Council, the regional wastewater treatment organization has issued surcharges based on effluent strength and volume to breweries to help pay for the water treatment. Fulton wanted to investigate ways to reduce their effluent strength and water usage, thus reducing costs and making their company more sustainable as they continue to grow.

"During Karl's internship, he identified areas of improvement on water consumption, waste water surcharge reduction, and boiler efficiency. He explored many engineering solutions for each problem and we are confident he found the most economical and dilligent process for us. We are grateful for his effort and will use his knowledge towards operating as efficiently as we can."
- Paul McDonald, Plant Manager, Fulton Brewing

SOLUTIONS

Water Reuse for Bottling Line Vacuum Pump

To increase beer shelf life, a liquid ring vacuum pump is used on the bottling line to evacuate air and CO_2 from the bottles before filling. The water in the pump heats up during operation, which reduces the vacuum. Warm water is discharged from the pump and replaced with fresh cooler city water at a rate of 5.25 gal/min. By adding an appropriately sized heat exchanger with a glycol loop, Fulton could cool and reuse the vacuum pump water. This would save up to 220,000 gallons per year. If Fulton does not install a recirculation loop on their vacuum pump, they should install a reclamation vessel next to the bottling line. This vessel would capture all the pump discharge and store it for use in floor rinses, fermenter clean in place (CIP) operations and additional spray rinses on the bottling line.

Canning Line Rinse Water Reduction

Fulton was using clean city water for both internal and external rinses on their canning line. Rinses are performed to remove any particulates on the inside of cans, and beer and foam on the outside. Because the cans are largely clean, the internal rinse water is suitable for external rinsing. The supply and demand of these two rinses were balanced by replacing low efficiency, high volume sprayers for the external rinse with high efficiency nozzles. The flow rate can continue to be fine-tuned with a needle valve to minimize water consumption. Reclaiming and reusing this water will save Fulton over 150,000 gallons per year in city water usage.

Replace Broken Valve on Kegging Line

All the rinsing bays in the kegging line have makeup water lines to compensate for water loss during operation. The makeup water is controlled with float valves. A broken valve on a caustic bay caused unnecessary hot water to be added, which overflowed strait to the drain. Fixing this valve will save Fulton 74,000 gallos per year of hot water and 540 therms for heating.

Evaporate Yeast & Trub Water-mix with Spent Grain

During fermentation, dead yeast and hops (cold trub) collect at the conical bottom of the fermentation vessel. When the beer is transferred to another fermenter or bright tank, all the yeast and hops at the bottom are drained out. These dumps contain the highest concentration of TSS and COD and are also the largest sources of TSS and COD in the effluent. A usual dump is between 300 and 500 gallons and when combined with the hot trub from the brewhouse, it can be responsible for up 2/3 of the total effluent strength charge. Instead, it can be side streamed to an evaporator, reducing its moisture content, mixed with spent grain, and sold as animal feed. This will drastically reduce Fulton's wastewater strength charge and generate additional revenue.

Install Flatjet Nozzles in Kettle

After beer is transferred to the fermenters, there is a large pile of hops (hot trub) left in the kettle. This material is high in organics and solids. To remove this, brewers use large amounts of water to fluidize the trub and spray it towards the drain. The trub is mixed with grain at the end of the night and the water is raked out. Fulton can install high efficiency flatjet nozzles to slide the trub to the drain. Installing these nozzles will reduce water consumption up to 41,000 gallons per year, and help minimize the volume of solids and organics entering the sewer, thus saving Fulton money on their strength charge.

Add Insulation to Boilers

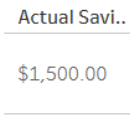
Fulton has two low pressure steam boilers used for production. The boilers have uninsulated head plates that are typically at 240° F. These plates radiate enough heat to elevate the boiler room temperature up to 130° F. Not only does this cost money, but it also makes working in that room unbearable.

Recommendation	Annual Reduction	Annual Savings	Status
Bottling line vacuum pump water reuse	220,000 gallons	$2,200	Recommended
Canning line rinse water reduction	150,000 gallons	$1,500	Implemented
Kegging line broken valve replacement	540 therms	$1,100	Recommended
Evaporator for fermentation waste	115,000 lbs solids	$9,200	Recommended
Install flatjet nozzles in the kettle	41,000 gallons	$400	Testing
Insulation for boiler head plates	1,600 therms	$1,000	Recommended

MnTAP Advisor: Michelle Gage, Assoc. Engineer

1 http://www.mntap.umn.edu/wp-content/uploads/simple-file-list/Intern/2010-2019/2017/karl-wuolo-journey-fulton-beer-summary-2017.pdf

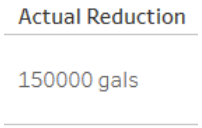
- **Actual Savings**: Actual yearly savings of US dollars as reported by the company for the suggestion. Listed as N.I. if the value is Null, which happens in the case that the suggestion was not implemented or we have not heard back from the company about the status of the suggestion.



- **Proposed Savings**: Proposed yearly savings of US dollars as calculated during the project for the suggestion. Represents the possible savings if the suggestion is fully implemented.

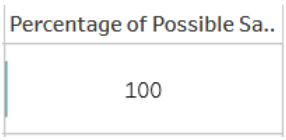
- **Proposed Cost**: Proposed cost in US dollars of implementation for the suggestion. Calculated by the intern for this specific project and could vary in future implementations of similar projects.

- **Actual Reduction**: Actual yearly reduction of gallons of water as reported by the company. Listed as N.I. if the value is Null, which happens in the case that the suggestion was not implemented or we have not heard back from the company about the status of the suggestion.



- **Proposed Reduction**: Proposed yearly reduction of gallons of water as calculated during the project for the suggestion. Represents the possible reduction if the suggestion is fully implemented.

- **Percentage of Possible Savings Achieved**: The percentage of the proposed savings achieved according to the actual savings value. Shows 100 if the proposed savings and actual savings are equal, as this would mean that 100% of the possible savings were achieved. Shows Not Implemented in the case that the Actual Savings value is Null, for the same reasons as described for the Actual Savings and Actual Reduction columns.



To see all of these statistics in a single, easy to read space hover over the Percentage of Possible Savings Achieved value to see the tooltip for that suggestion: