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## **T306: Concept Selection**

### **Summary of Methods**

We began by going back through our list of 100 concepts generated and discussed them more in depth. Specifically, we discussed the feasibility of these options. Assigning a feasibility rating ranging from 0-5, we rated each option as a means of cutting off concepts that would not be feasible enough for pursuing any further. Ideally, we knocked it down to our top eight concepts to pursue. The majority of these concepts we had already considered and brainstormed following our visits to the parks and facilities, as well as multiple discussions with the Leon County Office of Sustainability.

Going forward, our next means selecting our concepts was to specialize our ratings based on our targets and based on what our goals are for the project. To implement this, we made use of the House of Quality as a means of modeling our goals of the project. We considered our requirements and considered how they stack up comparatively. This provided us with a guide for which requirements were more important than others.

Following the House of Quality, we went through and plotted our top eight concepts into an AHP Decision Matrix. This was another means of narrowing our field further with what we could do, with what met our requirements. Finally, we compared the highest scoring concepts with each other through the Pugh Comparison Matrix.

Our goal with doing these methods was to reach the best one or two concepts that met our goals and could be done. With our project, we have the option to proceed with multiple concepts as a means of providing Leon County with multiple plans and designs that they could pursue.

### **Concept Feasibility: Baseline Selection**

The initial plan of action was to narrow our field of concepts initially with a feasibility ranking. This was done shortly after brainstorming the concepts and acted as our baseline for establishing higher feasibility concepts. We did this by ranking each concept from 0 to 5, 0 being not feasible at all, and 5 being exceptionally feasible and would be an excellent fit given our scope. Most of the concepts ranked 5 actually stemmed from ideas and miniature brainstorm sessions we had while we were touring the parks and facilities. The following pages show the concepts we had established, as well as their associated feasibility rankings.

No.	Concept Description	Feasibility
1	Pavilion charging station	5
2	Interactive renewable “instructable”	5
3	Hydroelectric powered water testing lake Munson	5
4	Irrigation controller	5
5	Hydroelectric charging station lake Munson	5
6	Renewable benches w/ charging station and Wi-Fi	5
7	Solar power trash cans	5
8	Solar power county events bulletins	5
9	Solar on county owned lakes	1
10	Windmills on city owned lakes	0
11	Workout station powered by renewables	3
12	Integrated solar panels on courthouse	2
13	Building material replacement	0
14	County fleet replace w/ electric	0
15	Window replacements on county bldgs.	0
16	HVAC regulators on facilities	3
17	Population sensor for HVAC	2
18	Population sensor for lighting	2
19	PV cell upgrades for park lighting	4
20	LED replacements for park lighting	3
21	Solar power net garbage collector for lakes	2
22	Solar powered porta-potties at park	2
23	Complete renewable rebuild of park restroom	0
24	Solar power fire/smoke detector	3
25	Solar power air quality detector	3
26	Solar power water quality detector	3
27	Wi-Fi canopy for parks	4
28	Renewable integrated water fountain pumps	3
29	Solar power clocktower	0
30	Coastal wind turbine integration county connect	0
31	Tidal turbine connect to county	0
32	Geothermal integration for utility connect	0
33	Spring-fed hydroelectric turbine	1
34	Automatic operating blinds for bldg. HVAC	3
35	HVAC upgrades across all facilities	0
36	Natural lighting integration for ceilings	0
37	Natural lighting design for walls	0
38	LED replacements for facility lighting	2

39	Rainwater reuse	2
40	Renewable integrated hurricane sensors	3
41	Renewable integrated weather stems	2
42	Wi-Fi areas for all parks	0
43	Renewable implemented pavilions	4
44	Solar power hot water heaters	4
45	Renewable benches w/ charging station	4
46	Renewable benches w/ Wi-Fi connectivity	4
47	Biomass integrated generating station	2
48	Renewable integrated billboards	4
49	Methane harvesting at landfill	2
50	County maintained electric vehicle charge stations	0
51	E-bike charging station	3
52	Landfill solar farm	4
53	Solar power water purifier	3
54	Solar power hydration stations	3
55	Renewable integrated UV index detector	3
56	Renewable power population detectors	2
57	Solar power handwashing station	1
58	Solar power temperature scans	0
59	Solar power digital bulletin boards	3
60	Electrify county owned heavy equipment	0
61	Public Wi-Fi canopies at all parks	1
62	Solar power lighting for all remote parks	4
63	Solar power lighting for all future parks	3
64	Solar power facility water heaters	2
65	Solar power microwaves for parks	1
66	Solar power refrigeration for parks	1
67	Solar power fans in existing pavilions	2
68	Solar charging stations on bike trails	4
69	Hydration stations for bike trails	3
70	Solar power air pump for bikes on bike trails	3
71	Security lighting for bike trails	2
72	Hydroelectric power lighting for lake Munson	2
73	Hydroelectric power for stormwater runoff	2
74	Solar security lighting for all county boat ramps	3
75	Solar integrated porta johns for boat ramps	1
76	Sustainable design bldg. for county example	0
77	Solar powered county owned parking gates	0
78	Moveable solar handwashing stations	1
79	Solar power animal feeding station	1

80	Solar power dog feed/water station	2
81	Solar power tennis ball launcher for parks	1
82	Renewable powered vending machines	3
83	Renewable powered occupancy sensors	3
84	Wearable human proximity sensors	0
85	Repurpose park for large scale solar integration	0
86	Solar powered fire starter for park cooking stations	1
87	Solar lawn care tools for county parks management	0
88	Solar powered playgrounds	2
89	Solar powered receptacles for county vehicles (outlets)	0
90	Large scale coastal wind integration for county connection	0
91	Airflow upgrades for parks and facilities	2
92	Wholesale purchase of solar integrated power	0
93	Solar powered shaded picnic tables for parks	1
94	Solar power bug zappers for parks	2
95	Solar powered compost collector	2
96	Solar powered security cameras for parks	1
97	Solar powered alarm systems	1
98	Solar powered PA systems	0
99	Solar powered park lockers	0
100	Solar powered radios for parks	1

# House of Quality

After analyzing the customer requirements, we developed these technical requirements needed to complete our project. Each technical requirement has its own associated target. We also developed the interaction between the engineering requirements and identified how both our customers and the technical requirements impacted each other. The house of quality below shows the project planning matrix (Engineering matrix), which was designed to demonstrate how the customer needs related directly to the technical requirement that our design will be depending on.

Quality Function Deployment  
(House of Quality)  
  
Team 306:  
Leon County Energy  
Improvements

Correlations:  
⊕ Strong Positive  
+ Positive  
⊖ Strong Negative  
- Negative

Customer Requirements		Customer Priority or Weight	Technical Requirements					Customer Assessment/ Competitive Evaluation
			Energy Storage	Output Power	Sunlight needed for PV system	Area usage	Budget	
Be used in Leon County facilities and parks	9				+			
Promotes Sustainability & Renewable Energy	10	⊕	⊕	⊕				
Adheres to Electric Utility Interconnection Requirements	9.5		⊕					
Implementable Design	8.5				+	+		
Conform to budget	6					⊕		
Follows a concise plan of action	8							
Targets			30	20	4	150	\$50	
			%	%	hours	ft <sup>2</sup>	thousand	

Technical Assessment

## AHP Decision Matrix

The AHP tabulates criteria needed for the project along with the top eight different design options pulled from the initial feasibility matrix. Each design option is given a score on how effectively it meets each criterion. A summation of these scores is then displayed on the bottom of the AHP decision matrix to rank the different design options. For our project, our team decided on utilizing a local park as our location.

	Pavilion charging station	Interactive renewable instruction	Hydroelectric powered water testing	Irrigation controller	Hydroelectric charging station	Renewable benches with charging station and Wi-Fi	Solar powered trash cans	Solar powered county event bulletin
Budget	5	3	2	2	1	5	5	5
Sustainable	5	3	3	2	3	4	5	5
Promotes renewable energy	5	5	3	2	4	5	5	5
Public exposure	5	5	1	3	5	5	5	5
Public use	5	5	0	0	5	5	5	5
Score	25	21	9	9	18	24	25	25

After evaluating all the designs and criteria, the pavilion charging station, solar powered trash can, Charging and Wi-fi benches and solar powered county event bulletin board were the projects that had the highest scores. We decided on these after careful consideration of the criteria. Each of them scored well in the budget category because they are realistic in terms of meeting our goals for the set budget. We also figured each of them were sustainable in that they would be regulated without the need of someone controlling them, and they would not use anything outside of renewable energy. Since our project needed to promote renewable energy to the public, we figured that these projects would best suit that requirement. With that, we also figured that the four would favor well in public exposure and public use. Each of these projects could be used by the community. In order to rank these four designs from best to worst we will need to put them in a Pugh Matrix where the criteria will be weighted.

## Pugh Comparison Matrix

At this point of the concept selection process, we had narrowed down our 100 initial ideas into four high feasibility options that met all of our requirements in essentially the same manner. In addition, we also have established which of our requirements correlate between technical targets and customer needs, as well as which are most important. Going forward, our last step is to compare these top scoring decision matrix concepts with each other on the basis of our requirements. For this, we are making use of the Pugh Comparison Matrix. The following tables will show how each concept under scrutiny stacks up when compared to the other concepts.

	<b>Pavilion Charging Station (ref)</b>	<b>Solar Power Trash Cans</b>	<b>Solar Powered Event Board</b>	<b>Solar benches w/ charging and Wi-fi</b>
Budget	-	0	0	0
Sustainable	-	+1	-1	0
Promotes renewable energy	-	0	0	+1
Public exposure	-	-1	+1	0
Public use	-	+1	-1	+1

	<b>Solar Power Trash Cans (ref)</b>	<b>Solar Powered Event Board</b>	<b>Solar benches w/ charging and Wi-fi</b>	<b>Pavilion Charging Station</b>
Budget	-	-1	-1	-1
Sustainable	-	0	-1	0
Promotes renewable energy	-	0	0	+1
Public exposure	-	+1	0	0
Public use	-	-1	+1	0

	<b>Solar Powered Event Board (ref)</b>	<b>Solar benches w/ charging and Wi-fi</b>	<b>Pavilion Charging Station</b>	<b>Solar Power Trash Cans</b>
Budget	-	0	+1	+1
Sustainable	-	0	-1	-1
Promotes renewable energy	-	+1	+1	0
Public exposure	-	-1	-1	-1
Public use	-	+1	+1	0

	<b>Solar benches w/ charging and Wi-fi</b>	<b>Pavilion Charging Station</b>	<b>Solar Power Trash Cans</b>	<b>Solar Powered Event Board</b>
Budget	-	+1	+1	+1
Sustainable	-	+1	+1	0
Promotes renewable energy	-	0	0	-1
Public exposure	-	-1	-1	+1
Public use	-	+1	0	-1

So, the question is what do these tables show? From the comparison matrices a number of points arise. It shows that the Bulletin Board concept is definitely the cheapest option and the Wi-Fi integrated park benches concept is the most expensive in comparison. However, while it is the cheapest option, the bulletin board does not promote renewable energy as greatly as other concepts do. This is due to the fact that while they would make use of solar panels for energy, it may not be a great amount due to the light load the board pulls compared to the other concepts. It does, however, have the added benefit of public exposure, due to the function of a bulletin board in of itself. As far as sustainability, it is not exactly an easy thing to compare objectively, but the powered waste bins have the added benefit of compacting waste as well as using solar energy to do so, it stands to reason it has double benefit in terms of sustainability.

These matrices have in total given us a greater understanding for how our top concepts stack up when related to each other. For our final concept selection, this will be the biggest assistance in determining not only what we want to pursue going forward, but to also justify why we want to pursue them.

## Final Decision and Justification

As we rounded up our decision-making matrices and charted our comparisons between the best concepts, we began working on which concept we would pursue. This was not an easy task. Multiple options could and would work out to meet Leon County's requirements, and the majority of these were not large-scale projects. This made us begin to think about how we could combine them to work to our advantage. The beauty of the project we are working on is that we can make use of a number of these options to meet our targets of tiering projects.

To put it differently, we began to question why we would need small, medium, and large sized projects when we could use different aspects and different smaller projects combined to account for these. For example, our smaller projects could incorporate a design and feasibility analysis of a charging station bench or a solar power trash compactor. Then, as we move into potentially larger options, we could combine these, such as a pavilion in which there is a charging station on the tables as well as Wi-fi connectivity and trash compactors.

The idea that guided us to this goes back to one of our assumptions: one big project will not attain Leon County's sustainability goals, but in the same manner that an ant eats an elephant, a number of smaller to medium sized projects can be applied to a number of locations to build up their renewable portfolio. This would allow Leon County's Office of Sustainability to have the chance to present multiple options to the Commissioners dependent upon what the budget was. Our goal is to present lower and higher cost options alike for their parks and even in some cases facilities that would continually push toward their goals.

So what does this look like? We decided on using our top three concepts, and worked on how we could potentially combine these into their own projects. These included the Solar Power Trash Compactor, the Charging Station Bench, and the Pavilion. The compactor can be a unit on its own, an addition that can be done. Our plan is to provide a feasibility analysis for one with no communication capabilities, as well as one that can communicate its fill level. Additionally, the charging station bench would be a singular unit, one in which we could provide feasibility analyses for Wi-Fi connectivity as well as with just charging capabilities. In addition, the pavilion could encompass benches as well as trash compactors. Our goal with this is to provide a small, medium, and large pavilion option, and the feasibility analysis for all three.

By the end of this project, our goal now is to provide these options for the Office of Sustainability's consideration. Our analyses ought to be full breadth, including costs associated with them, and using solar power, how long it will take to pay for each of these. In addition, we plan on providing design packages for each that will allow Leon County to construct these with as minimal questions as possible.

With the conclusion of concept selection, we now have our plan in place. In the coming days and weeks our goal is to zero in on what all needs to go into these feasibility analyses and designs and begin our pursuit compiling these plans. As stated in earlier sections, our project is different from others, but we are excited to begin working on this multi-faceted project.