

Becoming a Circular Economy

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Abstract

A group of Civil Engineers from Gonzaga University was fortunate enough to receive the opportunity of exploring the Netherlands. The Gonzaga in Delft program provided a learning opportunity to understand the sustainable actions that the Netherlands are taking to ensure a more hopeful future for their country. Cities in the Netherlands are working on many waste diversion and material conservation strategies. One strategy was seen in BlueCity, an old waterpark building that provides a platform for entrepreneurs that share common goals of reducing the use of natural materials, making products that will last longer, and using or recycling products and parts. An innovation they came up with is called SeaWood. They created a way to utilize the renewable resource, seaweed, in building material that is natural, reusable, and compostable. The Jensen-Byrd building in the university district can be an excellent place for us to implement something like BlueCity to bring Spokane closer to becoming a more sustainable city.

Chapter 1: An Introduction of a Sustainable City

The world's call for sustainable development in cities is especially important with the rise of environmental and climate challenges. Before the start of the Gonzaga in Delft program, an article that was given defined Sustainable development as “meet (ing) the needs of the present without compromising the ability of future generations to meet their needs.” (Ayers, 2017). The tasks that civil engineers perform are important to the development of sustainability, but it is everyone's responsibility to take care of our world to ensure that future generations are not depleted of natural resources. This program inspired Gonzaga Students to generate goals that involve implementing sustainable practices in Spokane as the Netherlands showed that it is possible to live sustainably. This chapter will dive more into what makes a sustainable city, why it is essential, and the role civil engineers have in promoting sustainability.

A sustainable city is a city that meets the needs of people today without depleting resources for future generations. Society, economy, and environment (also known as people, prosperity, and the planet) are the three components of sustainability that will keep high-level well-being (Ayers, 2017). In “The Urban Green” video from the World Wildlife Fund, they provide three actions that will allow cities to strive to meet the goal of becoming a sustainable city. These are factors that everyone must take together, and they include becoming low carbon, resiliency, and utilizing our ecosystems to support our sustainability (The Urban Green, 2016). These three factors are what will keep our natural world safe and prevent the depletion of resources for future beings.

Cities are the main contributors to environmental challenges as they consume most of the world's energy and produce a ton of waste and emissions. Focusing on sustainability at the city level is important because it is where all the environmental issues stem. The city must be sustainable in its inflows and outflows of energy, water, and food to plan for areas outside the city as well. We focus on sustainable cities because of the interconnectedness they have with regions outside of them (The Urban Green, 2016). When we give more attention to where the largest contributors to environmental issues come from, then that will effectively lead to a proper system that will in return benefit people all around and the environment.

Buildings and energy, transportation and land use, waste diversion and material conservation, and water resources are all areas of action within Civil engineering that plays a major role in promoting a more economically, socially, and environmentally sustainable urban

environment. Civil Engineers that concentrate on buildings and energy, must come up with sustainable building methods because they oversee the type of materials used, the use of fields they want to build on, and the destruction of structures (Team, 2019). Waste management engineers are responsible for figuring out ways to reuse and efficiently discard waste and materials (Average Waste Management Engineer Hourly Pay, n.d.). Transportation engineers plan and create transportation networks like roads, bridges, airports, railways, and harbors. Water resource engineers design and create treatment plans, supply systems, pipelines, and pump systems to ensure that the public gets clean water while also managing wastewater (Water Resource Engineering: Trends and Careers in Civil Engineering, 2021).

These areas of action all play a vital role in the three components of sustainability because when creating these plans for the public, they must take into consideration what is best economically, which is finding what will continue economic growth. They should also keep in mind social sustainability by looking into what will benefit current and future generations to allow for continuous healthy living. Finally, engineers must create a plan that will also promote environmental sustainability to protect our ecosystems and conserve our natural resources. This is a general introduction to what comprises a sustainable city to understand how we as a community can implement sustainable practices in the City of Spokane.

After reading this report, the goal is to inspire the City of Spokane to act now and start moving in the direction of becoming a more sustainable city. The next chapter will explain the role waste diversion and material conservation plays in the City of Spokane and the Netherlands. Then the following chapter will introduce a waste diversion and material conservation strategy that the Netherlands uses and can hopefully influence the City of Spokane to practice as well.

Chapter 2: Waste Diversion and Material Conservation in Cities

For the City of Spokane to see any sustainable development one area they must focus on should be on waste diversion and material conservation. This looks like conserving our natural and finite resources, utilizing more renewable resources, and recycling, reusing and composting to reduce waste. Envisioning the use and management of materials is a way to preserve value, lower environmental impact, and conserve natural resources (How Communities Have Defined Zero Waste, 2021). This chapter will discuss the role waste diversion and material conservation plays in sustainable cities, what it looks like from the Spokane and Dutch perspective, and the impact it has on the economics, natural environment, and health and wellbeing of a city.

Waste diversion and material conservation are important aspects of creating a more sustainable city. Reusing and conserving materials will prevent any detrimental effects on the ecosystem. Some of these include climate change, pollution, harm to animal and marine life, and water contamination. Diverting waste promotes sustainability because it will create ways to supply the public with materials that can be reused and/or recycled therefore reducing the effects of these negative outcomes for future generations to deal with. Continuing to use natural resources to produce products and materials will cause them to eventually run out as they are finite. This harms future generations because they will not only have zero access to the finite resources, but they will also deal with the effects of the waste. Implementing this area of action in cities is vital because cities make up a large portion of our world's waste. In cities, there are many shops and restaurants for people's convenience but unfortunately, this creates more packaging waste and food waste.

The City of Spokane is implementing ways to support waste diversion and material conservation. In the Spokane Sustainability action plan, they provide two goals for this area of action. These include investing in programs that focus on reducing the amount of solid waste and promoting programs that focus on circular waste to increase economic activity (Spokane, 2021). In 2018, each person in Spokane county produced an average of about 3.3 pounds of waste per day and the county produced 310,677 tons of waste that went to the waste-to-energy plant or the landfill. All this waste contributed to a large number of carbon emissions into the atmosphere, therefore harming the environment. The city set a goal to have a 95% reduction of carbon dioxide emissions coming from waste to energy and biogenic emissions by 2050 (Table 1). If

Spokane can meet its goals, it will lead to less pollution, more jobs, and improved well-being of the public (Spokane, 2021).

Table 1. Carbon Dioxide reduction targets in the coming years from waste to energy and biogenic emissions.

Sector Level GHG Targets: Waste Diversion & Material Conservation

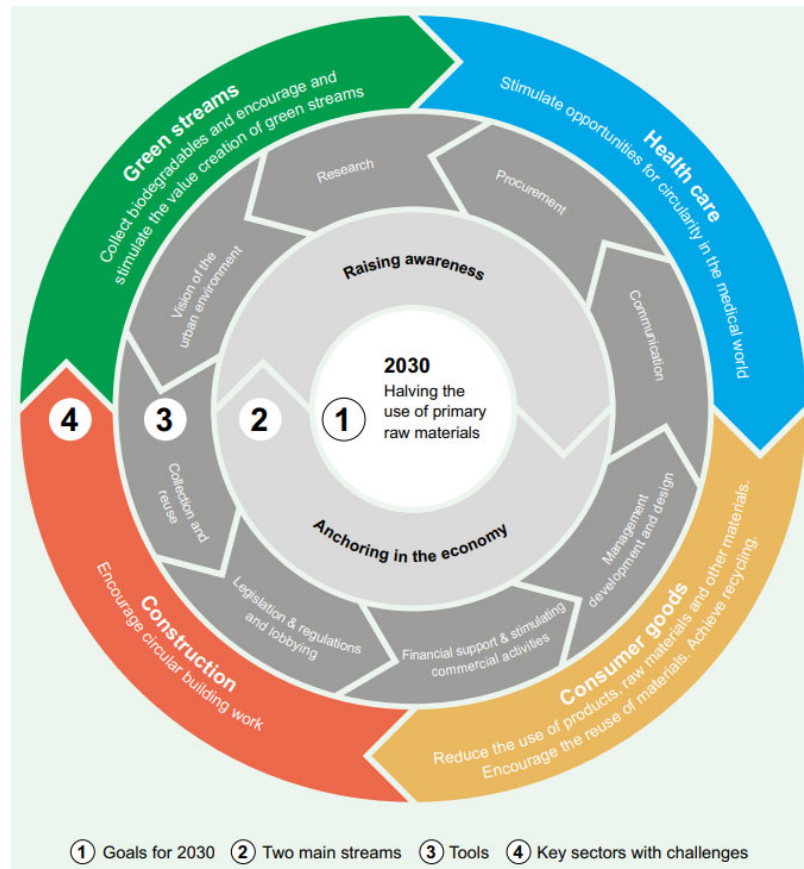
Vehicle Type	2016 Baseline		2030 Reduction Target 45% & 948,958 MT		2040 Reduction Target 70% & 1,476,155 MT		2050 Reduction Target 95% & 2,003,356 MT	
	Metric Tons CO ₂ e	Percent of Total	Metric Tons CO ₂ e	Percent Reduction	Metric Tons CO ₂ e	Percent Reduction	Metric Tons CO ₂ e	Percent Reduction
WTE	100,533	5%	65,346	35%	50,267	50%	5,027	95%
Biogenic*	136,713		68,357	50%	34,178	75%	6,836	95%

*Biogenic emissions in this table refer to the combustion of biological material in the municipal waste stream. It is outside the scope of our community GHG inventory; however, these emissions can be reduced through food rescue initiatives, composting biological material into soil amendments, or digesting into biofuels. In other words, there is a higher and better use for these materials outside of direct incineration.

(Spokane, 2021)

Along with Spokane, cities in the Netherlands also have a plan in action to support waste management. Cities are working towards creating a circular economy, this means building the economy while also avoiding and reducing natural materials, creating products that will last, reusing products and parts, and recycling materials (Programme, 2019). Rotterdam is a notable example of how a city in the Netherlands is becoming a circular economy. Their goal is to half the amount of primary raw materials by 2030. The second ring includes two pathways and possibly the most important aspects in meeting their goal and they include raising awareness and anchoring circulatory in the economy. Seeking change means making sure everyone is in the same boat and a collective effort from the city is present. A specific example of how cities in the Netherlands are implementing a circular economy will be addressed in the next chapter.

Figure 1. The city of Rotterdam, Netherlands displays their goal for 2030 (ring 1) and the factors that will lead them to their goal (rings 2-4).



(Programme, 2019)

Focus on waste diversion and material conservation can provide positive impacts on a city's/region's economics, natural environment, and health and wellbeing. Economic prosperity is being resilient by allowing people and businesses to thrive during economic growth and challenges (Spokane, 2021). A circular economy can generate economic prosperity in cities because it creates more jobs and promotes economic development (Cities in the Circular Economy: An Initial Exploration, 2017). The creation of new products that will arise from a circular economy will lead to more jobs with the refurbishing and repairing products and the planning that come out of it. Waste diversion also improves a region's natural environment,

ensuring that our air, water, soil, plants, and wildlife remain healthy (Spokane, 2021). Reducing the amount of waste can allow for less pollution, lowering contamination in our water and soil, and prevent more harm to plants and animals. Finally, ensuring proper health and wellbeing means investing in public health by giving access to healthy food, cheaper housing, and strong infrastructure (Spokane, 2021). Having less unprocessed waste in dump sites will allow for air quality improvement, less congestion, and less pollution (Cities in the Circular Economy: An Initial Exploration, 2017). Overall, waste diversion and material conservation can lead to great outcomes in our world's economy, natural environment, and health and wellbeing if put into practice in cities.

Waste diversion and material conservation play a significant role in sustainable cities. Spokane and many Dutch cities have already created plans to reduce the amount of waste produced. These plans will have a strong and positive impact on the economics, natural environment, and health and wellbeing of all the cities if they are put into action. The next chapter will introduce one strategy the Netherlands is using and that is creating a sustainable material called SeaWood.

Chapter 3: SeaWood in Blue City

Cities in the Netherlands are creating many strategies to support the area of waste diversion and material conservation to work toward becoming sustainable cities. During the Gonzaga in Delft program, the Civil Engineers were able to tour BlueCity in Rotterdam. The building that BlueCity is held in is incredibly unique as it was once a working water park that was too great to tear down (figure 2). Today, it serves as a wonderful place for entrepreneurs to create sustainable and circular innovations that promote a circular economy. An amazing innovation created in BlueCity came from Marjanne Cuypers. She created SeaWood, a way to utilize seaweed to create building material (figure 3). Once this innovation is growing, it will be a life-changing product as it will positively affect our climate (SeaWood Materials, 2021). This chapter will address the positive environmental, economic, and health and well-being impacts it will have on cities. It was also look at ways this strategy fits into the goals of the City of Spokane, along with the good outcomes to come of it.

Figure 2. Gonzaga in Delft Students on a tour at BlueCity in Rotterdam, Netherlands.



SeaWood will have a strong environmental impact on the world once it is properly tested and the process is scalable. Seaweed is a natural renewable resource as it grows in every sea in the ocean which makes up 71 percent of our planet (Pielou, 2021). The production of seaweed is efficient and will not bring any harm to the planet. It grows at twice the rates of land crops and does not require any special fertilizer or pesticide to grow properly. Seaweed can also absorb copious amounts of carbon dioxide, therefore, reducing the number of harmful gases in our atmosphere (Pielou, 2021). SeaWood will also boost our economy as it will provide more housing and jobs for the public. This will have a significant impact on the construction industry and will be an excellent product for builders, architects, designers, and even consumers (SeaWood Materials, 2021). Improving the health and well-being of the public is another benefit of Cuypers' innovation. The building material can be used in homes and offices, providing a good environment for people. Since seaweed reduces carbon emissions it will improve the health of the public as it decreases the amount of pollutants they inhale. SeaWood comes with many benefits and that is why the Seaweed company and BlueCity Lab workers are working to improve and scale this product (figure 3).

Figure 3. A piece of SeaWood that Majanne Cuypers made in BlueCity labs



Spokane and the Netherlands can learn from one another by understanding the strategies that support their goals. A couple of goals in the Spokane Action Plan call for promoting circular waste programs that benefit the economy and having a 95% reduction of carbon dioxide emissions and biogenic emissions by 2050 (Spokane, 2021). Investing in a program like BlueCity can bring in innovations that support a circular economy and would support these goals if implemented in the City of Spokane. Not only will SeaWood help to reduce the number of emissions in the atmosphere and have a positive benefit economically, but all the innovations that start-up in BlueCity will have similar benefits to meeting goals such as ones from the Spokane Action Plan. Implementing something like BlueCity in Spokane could bring good possible outcomes to the City of Spokane. It will serve as a platform to allow circular entrepreneurs to create innovations such as SeaWood. New ideas and products can be created in an environment where entrepreneurs would feel comfortable and inspired. Having a platform that brings out fascinating and sustainable innovations can also create awareness among the public. For example, learning about SeaWood and the benefits seaweed has on the environment is intriguing and can inspire and educate the public about the effects waste has on our planet. BlueCity is an amazing takeaway from the Netherlands that supports the goals of the City of Spokane and brings out great outcomes.

This strategy will look different if applied to Spokane compared to cities in the Netherlands. During the three weeks in Delft, the Gonzaga Civil Engineering students found that there were many practices to reduce waste in the Netherlands. Reusable bags, one-ply toilet paper dispensers, lots of vegan options (in restaurants and grocery stores), and many more. Students noticed that few strategies for reducing waste are common around the Netherlands therefore it can be concluded that there is more public awareness about the negative effects waste has on the planet. More public awareness means there is more opportunity to start up programs just like BlueCity. In Spokane, a challenge they may have in starting this type of program could be the lack of awareness. It can be easy for cities to produce a lot of waste due to wanting to attract and provide convenience for consumers (Pielou, 2021). This could present a challenge but is possible to overcome. Informing and educating residents and businesses about this strategy is the first step to making it work. This can begin with the group of Gonzaga in Delft students presenting what we learned from the Netherlands.

Chapter 4: Conclusion and Recommendations

Reversing the rise of environmental and climate challenges starts with creating goals and strategies to foresee sustainable development in cities. Becoming a fully sustainable city is the end goal and that means providing for the needs of people without affecting future generations' needs. People, prosperity, and the planet are three important components that should always be considered when looking at how to become a sustainable city (Ayers, 2017). Civil Engineers consider these three components in all areas including buildings and energy, transportation and land use, waste diversion and material conservation, and water resources. This report focused on waste diversion and material conservation and how the City of Spokane can utilize what students from the Gonzaga in Delft program learned from the strategies the Netherlands uses to reduce waste. They share a common goal within this area of action and that is promoting a circular economy therefore Spokane and the Netherlands can learn from one another. Spokane has the opportunity of finding a place, money, and raise awareness to create a platform like BlueCity that promotes the creation of circular products. One of the challenges is getting enough people involved and on the same page but with a collective effort, Spokane will be on track to becoming a sustainable city.

Figure 4. The abandoned Jensen-Byrd building in Spokane County



A recommendation for a place to start up a platform similar to BlueCity is the Jensen-Byrd building (figure 4). This is a large, six-story, abandoned warehouse that would be a great spot to renovate and build labs, offices, and any type of room that will allow circular entrepreneurs to make their vision into a reality (Jensen-Byrd Building, n.d.). If it is possible to make the Jensen-Byrd building into a place that promotes sustainable and circular innovations then this will bring the City of Spokane closer to their waste diversion and material conservation goals.

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