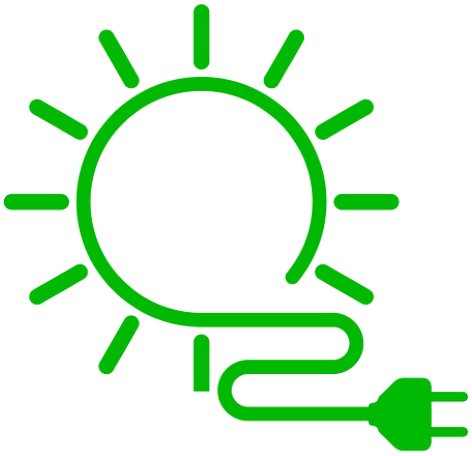

SOLASTA ENERGY CONSULTING

Abby Fluckiger
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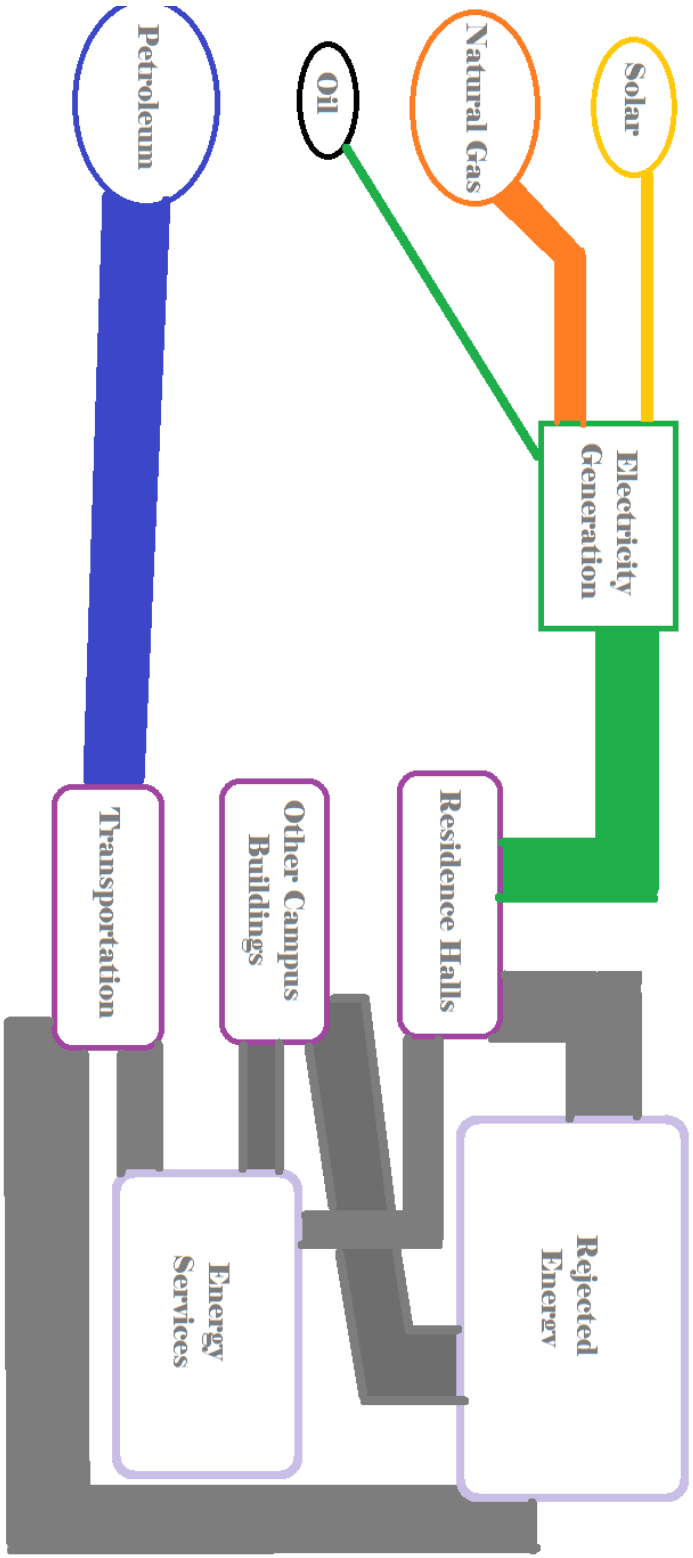
Petroleum
Oil
Natural Gas
Solar
Electricity Generation
Transportation
Other Campus Buildings
Residence Halls
Energy Services
Rejected Energy

Scope 1 Uses at Westfield State University

Energy Use	**How It Can Reach 100% Renewable**
Space Heating Water Heating (Powerplant)	-Replace with more efficient and renewable option(s) (cogeneration plant, biomass plant, geothermal)
Campus Vehicles (Public Safety / WSU Police)	- Replace with more fuel efficient vehicles (hybrids, electric vehicles, or new/more efficient)

Scope 2 Uses at Westfield State University

Energy Uses	**How It Can Reach 100% Renewable**
Buying Electricity from Westfield-based power company	Power Purchasing Agreement (PPA) Renewable Energy Credits (RECs) Solar Energy

Scope 3 Uses at Westfield State University

Energy Use	**How It Can Reach 100% Renewable**
Travel (faculty trips)	Carbon credits Eco-friendly travel initiatives
Commuting (faculty and students, PVTA buses)	Carbon Offsets

Solar Field Calculations:

The Horace Mann Center Solar Field	• kWdc: 2378.7 • m2: 15858 • kWh over 1 year: 2,708,633 • Percentage of current system: 16.68%
Adjustments to Parameters (Enhancing kWh)	• Changing module to 'Premium': 2,719,316 kWh • Changing tilt of panels to 35 degrees: 2,721,667 kWh • Changing inverter efficiency to 99.5%: 2,741,063 kWh
Ability to Reach 100%: Yes	• Just by covering one athletic field, the South Lot, and a small portion of the property behind South Lot, we reached over 100% easily

To-Do

Monday March 26th: Report Draft Tasks 1-11

- **Editing first deliverable:** Kelli
- **Task 7:** Collaborative effort
- **Task 8:** Abby
- **Task 9:** Dominic
- **Task 10:** Noel
- **Task 11:** Kelli

Monday April 2nd: Revise First Drafts

Wednesday April 18th: Progress Reports

Friday April 27th: Individual Reports due

Friday May 4th: CURCA Poster Presentation

The Big Picture

Things we don't know	**Questions**
Time frame of project	● How long will installation take? ● How long will it take for the cost to even out with the savings? ● Can we be fully renewable by 2050?
Cost of new system	● How much will the new system cost? ● Will it break even?

Geothermal Plant at Westfield State

Pros	Cons

- Produces less pollution
- "Green" energy
- Renewable resource/cannot exhaust resource
- Can produce terawatts worth of energy
- Makes heating and cooling easy (better for summer and winter classes)
- Doesn't involve fuels to harness
- Partially underground (won't infringe much on campus space)
	- Have to build new plant on campus
	  - Time to build new plant
	  - Tearing down old plant for space
	- Very expensive up front
	- Not profitable in all locations
	  - Is Westfield State a viable location?
	- Digging underground/under parking lots can affect student life and classes
	- In extreme cases: tremors or earthquakes can be a result

Co-Gen and Biomass Pros and Cons

Cogeneration Plant at WSU

Pros	Cons
- We will be able to supply our buildings with both **heat** and **electricity** - Higher efficiency - Natural gas is cleaner than oil - More sustainable than current model - Easy retrofit to our current plant - We can create our own mini micro grid; we become a supplier - No more transmission lines - Low risk: Cogeneration is already an established technology	- We can't claim to be renewable (on our time scale) - We continue to pollute the air - We have energy dependence. We are stuck paying for a source (natural gas) that we have no control over

Biomass Plant at WSU

Pros	Cons
- Biomass burning is a renewable energy source - Less dependent on fuels; fuel is also highly available - Carbon Neutral - Cleaner than fossil fuels	- Fuel cost is significantly less than gas, oil, or an electricity provider - Deforestation/ harming natural habitat (not necessarily on campus) - Isn't exactly clean energy; burning is still necessary

Scope 1 energy uses include emission sources that are controlled and owned by the institution, these are known as direct greenhouse gas emissions. Scope 1 energy uses can be categorized into four different groups:

- Stationary combustion
- Mobile combustion
- Process emissions
- Fugitive emissions

For Westfield State University, the majority of emissions are from stationary and mobile combustion which include:

- fossil fuels such as: natural gas, fuel oil, and propane used for heating purposes
- -gasoline, and diesel fuels which are used for transportation.

Below is a list of Westfield State University's scope 1 emissions:

- campus cars
- shuttles
- maintenance trucks
- service vehicles
- maintenance equipment (lawnmowers, chainsaws, snow blowers etc.)
- diesel machinery (front loader tractors)
- heating

Scope 1 emissions for Universities can account for a large percentage of total greenhouse gas emissions and should not be overlooked (Figure 1). Scope 1 emissions are also relatively simple to monitor, manipulate and change because they are under control of the institution.

Sheridan College 2014/2015 GHG emissions

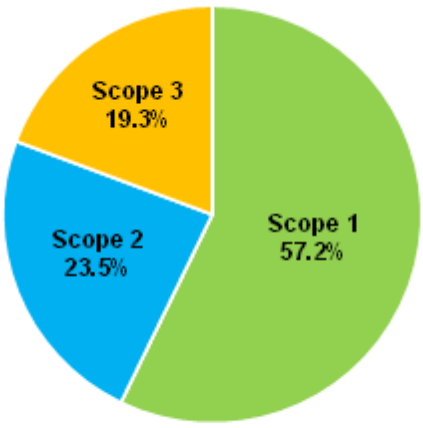

Figure 1. Scope 1, 2, and 3 emissions are displayed as percentages for Sheridan College in Ontario, Canada. This college is larger than Westfield State University; however the concept is the same. (Image sourced from Sheridan College. http://missionzero.sheridancollege.ca/)

Alternatives for the scope 1 emitters above is as followed

1. Replace vehicles that run on gasoline with electric vehicles or biofuel powered vehicles.
2. Purchase electricity from renewable sources.
3. Update/replace campus power plant to run on biomass

4. Purchase electric maintenance equipment5. Run diesel equipment on biodiesel

Updating all of the scope 1 emitters on campus is costly. This transition may need to be done over a period of years.

Title: Westfield State 100 Percent Renewable by 2050

Authors: Abby Fluckiger, Kelli Grafton, Noel Lioce, Dominic Ottolini

Renewable energy is a necessary step for the overall health and progress of societies. It helps maintain the health and sustainability of our environment, while also leaving a sustainable earth for future generations. In addition, more efficient and more eco-friendly energy solutions are also more cost-effective when considered over the long term.

Renewable energy is a necessary step towards improving the overall health and sustainability of society and the environment.We have evaluated the energy needs of Westfield State University and assessed our current energy uses and sources to help determine the best possible path towards 100 percent renewable energy at our institution. This required a) investigation of the various technologies, solutions, and strategies available to implement cleaner and more-efficient energy sources, 2) assesses the costs of upgrading or replacing our existing systems, and 3) evaluate how much money Westfield State University could save in the long-term with newer, cleaner, and more-efficient energy systems. There are substantial upfront costs involved in ‘going-green’, some of which may be offset by local, state, and federal incentives. In addition, there are also other significant permanent ‘costs’ such as; loss of accessible open space to solar photovoltaic arrays. Other temporary costs include; construction for the drilling and installation of a geothermal system. There are clear advantages and disadvantages to each of these options.

The Westfield State University community has to engage in conversations about our institutional priorities and what compromises we are willing to make if we choose to transition to a 100 percent renewable energy campus – a transition that is entirely possible.