Solar Sausage Team 'B'- E#2/M#26

Final Presentation

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Senior Design Instructor: Dr. Michael Frank

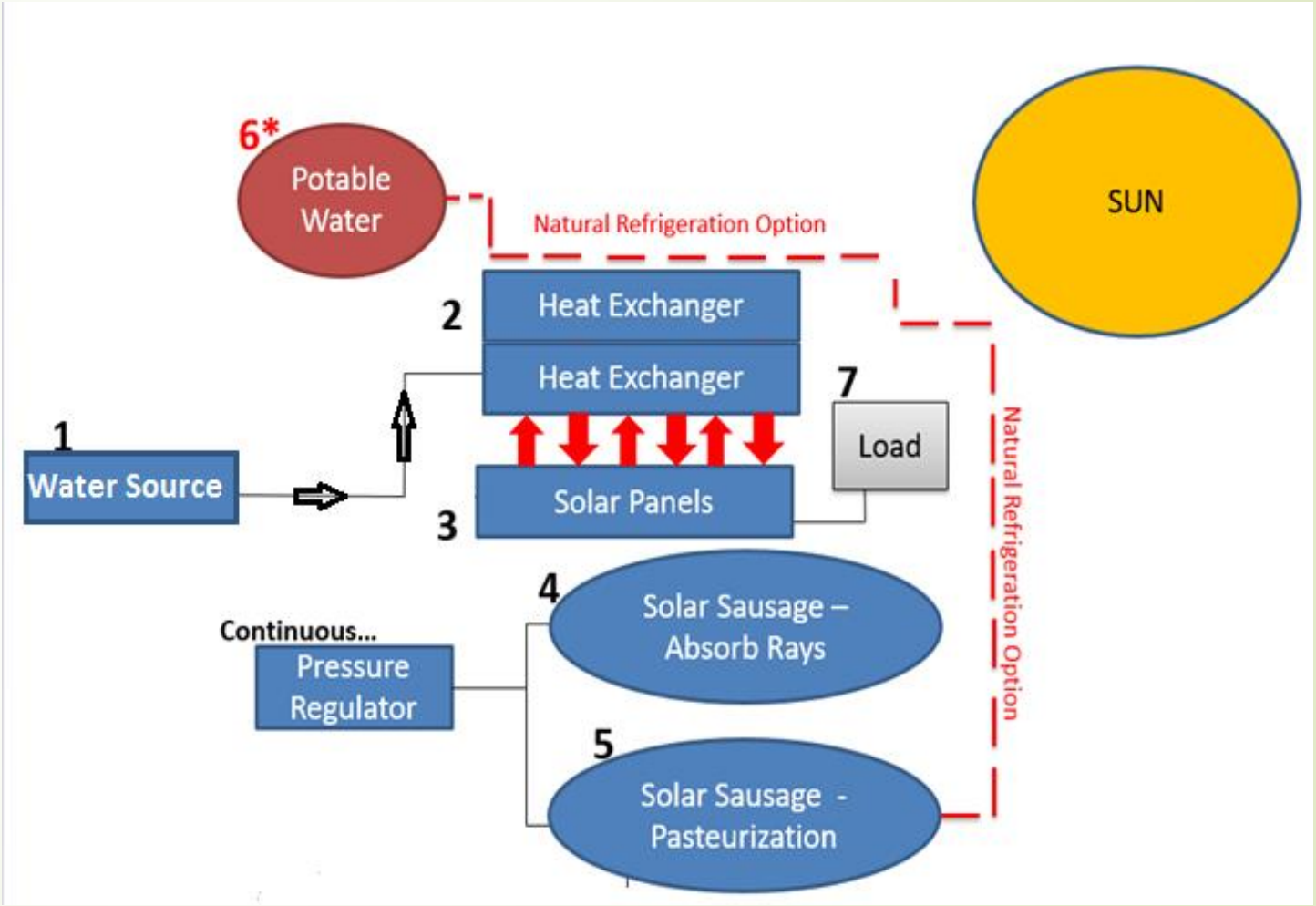
Technical Advisors: Dr. Edrington & Dr. Ordonez

Final Design!!

Speaker: Jimmy Smith, Jr.

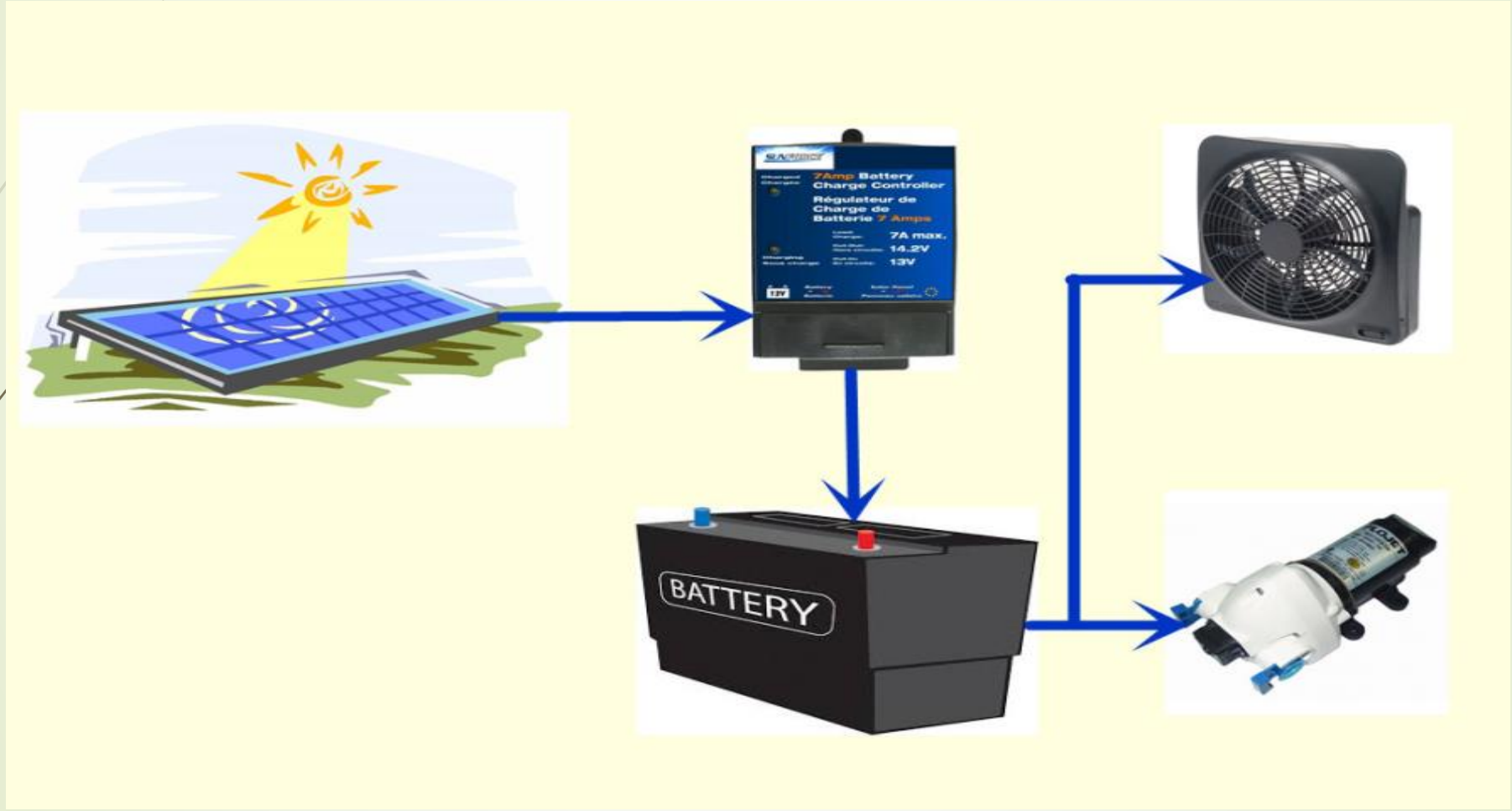
Overview: Solar Sausage

- Problem
  - Current model: inefficient
  - Solar panel cooling system
  - Impoverished countries
- Intended use/users
  - Provide electricity
  - Potable water
- Operating Environment
  - Dry climates
  - Location: Panama



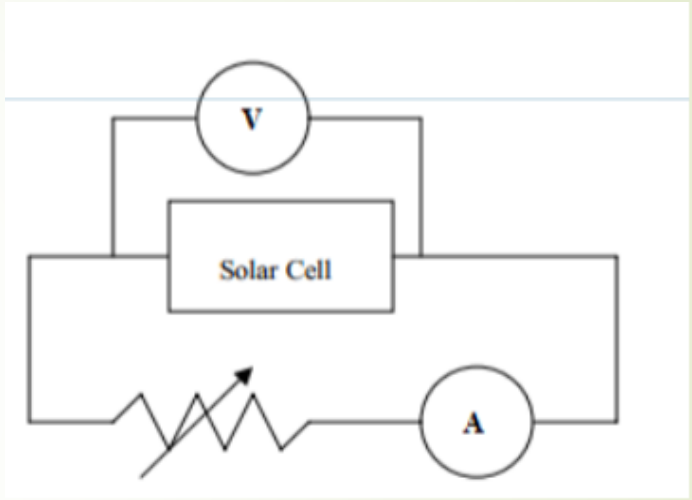
Speaker: Jimmy Smith, Jr.

Overview of Solar Power System



Speaker: Xiaoxiang Gao

Solar Power Test

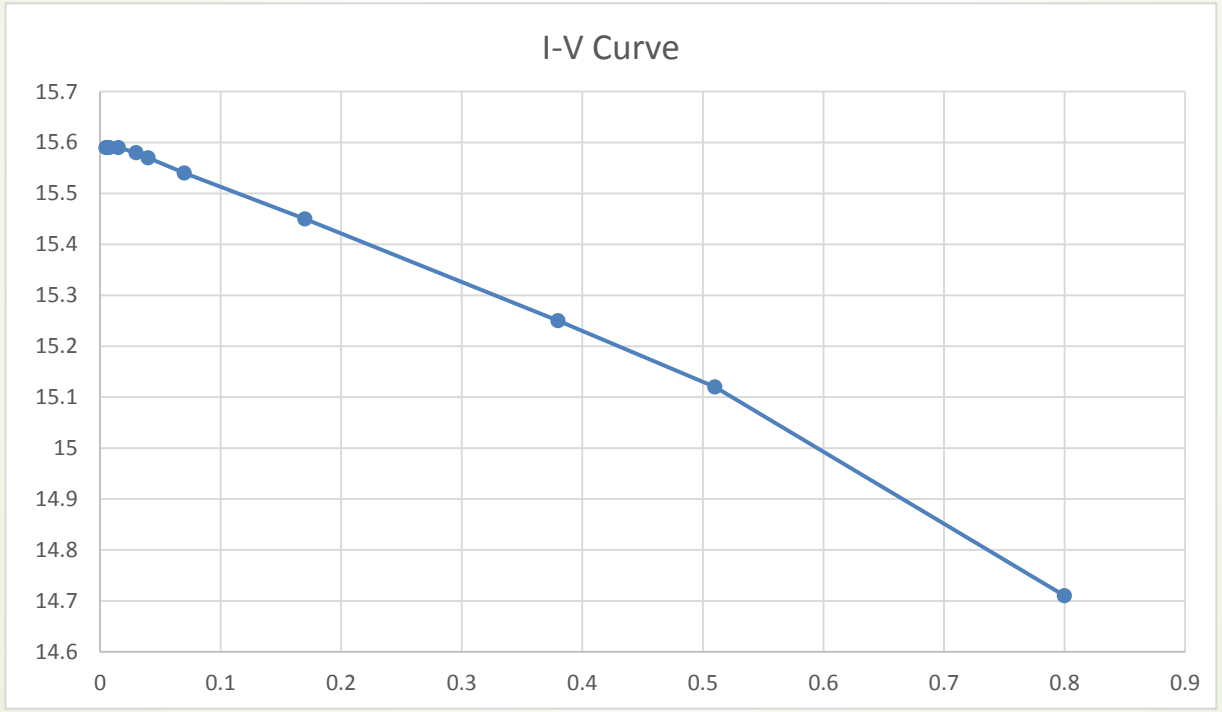


- Test Equipment:

Solar cell, Protractor, Light source, Power source, Ammeter, Voltmeter

Solar Power Test

Actual Results:



Charge Regulator

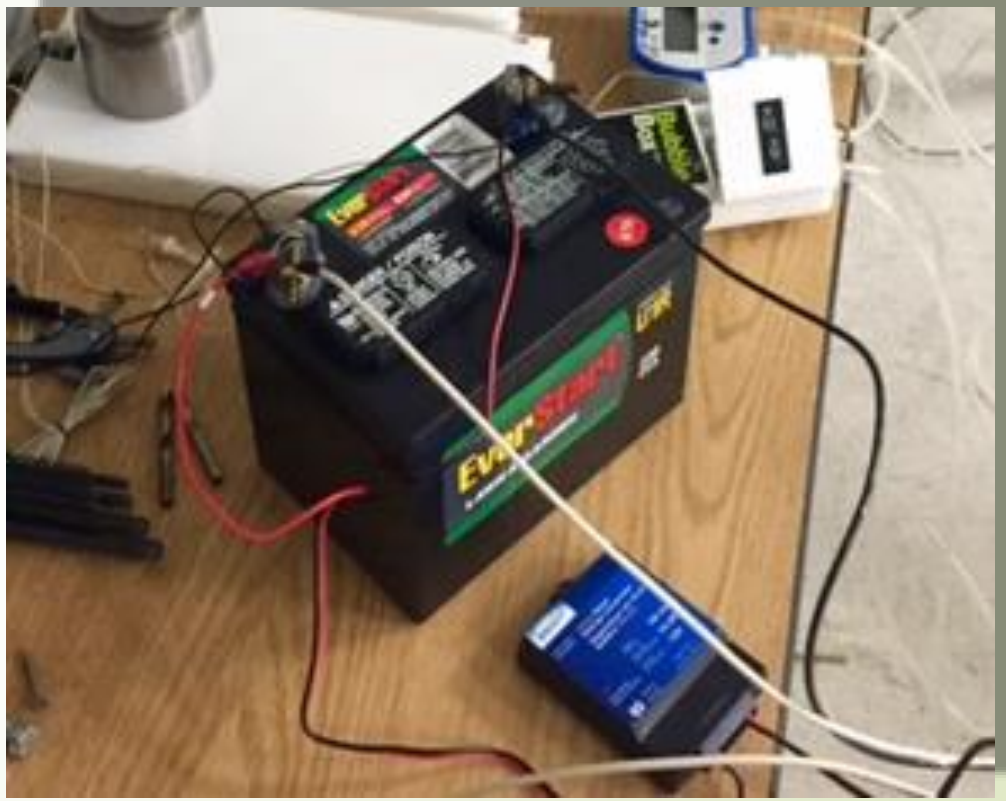
Sunforce 7A Battery Charge Regulator

- **Used for the 12VDC battery**
- **Protect the battery from overcharge**
- **Protect the battery from over discharging**
- **According to the battery voltage grade, the controller can automatically set charge-off voltage, the load-off voltage, the load- restore voltage.**

Speaker: Xiaoxiang Gao

Energy Storage Device

- Everstart U1R-7 12V Lawn&Garden Battery
- Supports our 35 W load
  - 4.1 W drawn from fan
  - 25W drawn from water pump
  - 6W drawn from solar panel
- Solar Panel Data
  - 16V @ 2.5A = 40W
  - Positive Net Energy of 5W



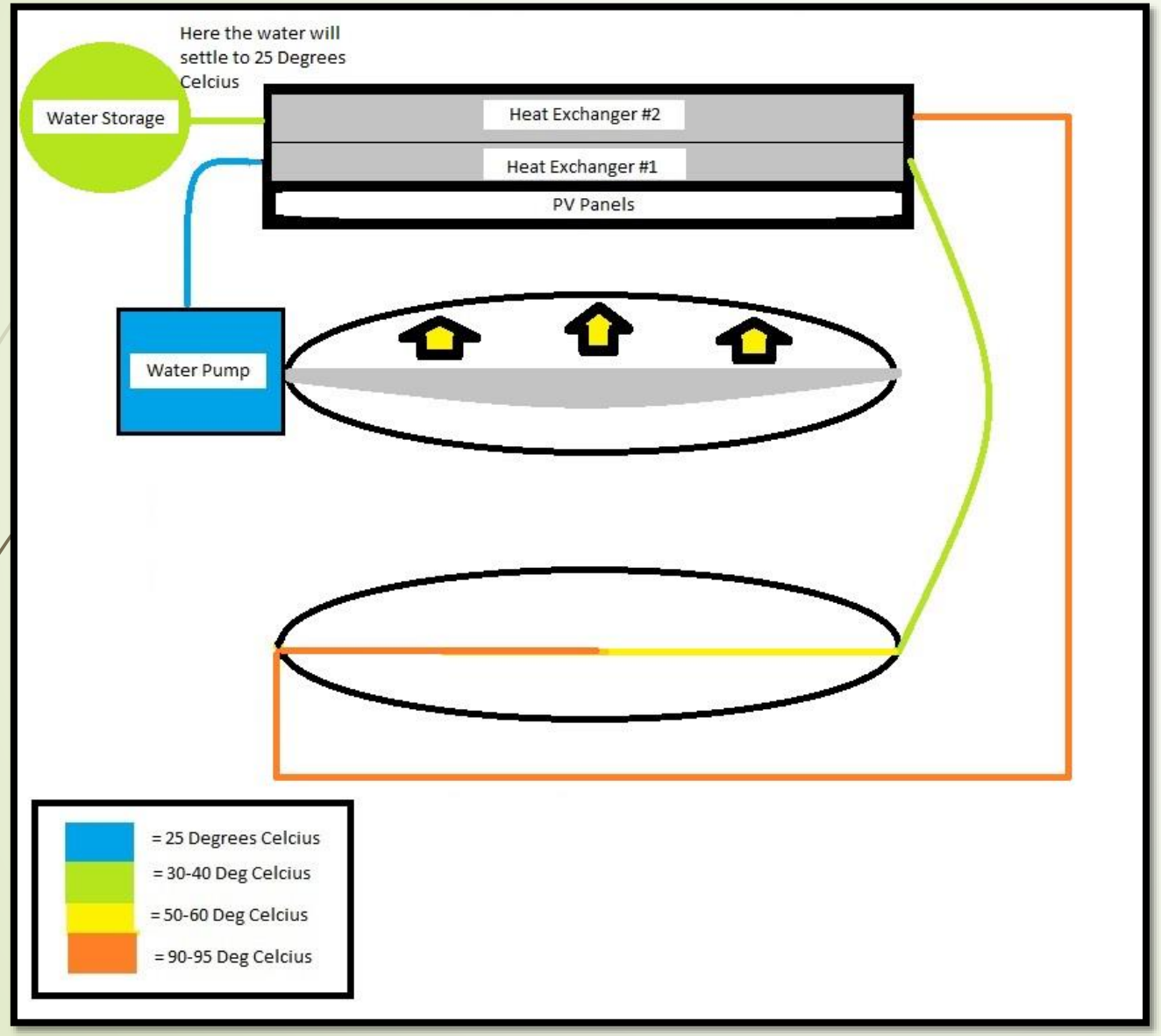
Speaker: Aileen Ulm

Load Experimental Values

- Voltage
  - 12 V
- Current
  - 280 mA (on low)
  - 340 mA (on high)
- Power Absorbed
  - 3.36 W (on low)
  - 4.08 W (on high)

Speaker: Jonathan Melton

Pasteurization Process

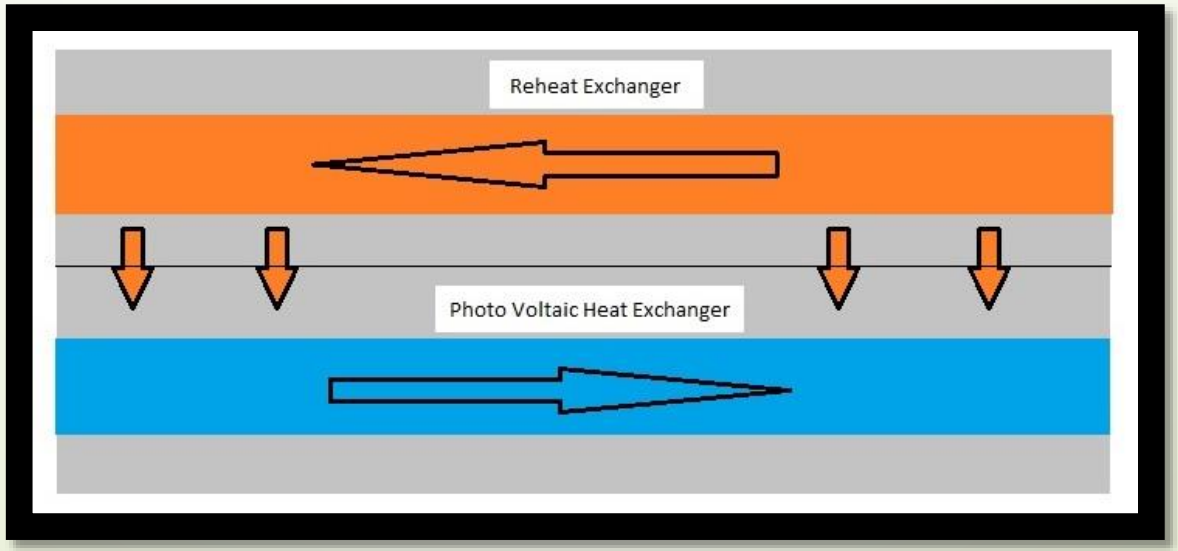


- Counter Flow Design Heat exchanger
- One Sausage for energy production
- One sausage for pasteurization

Speaker: James Harrell

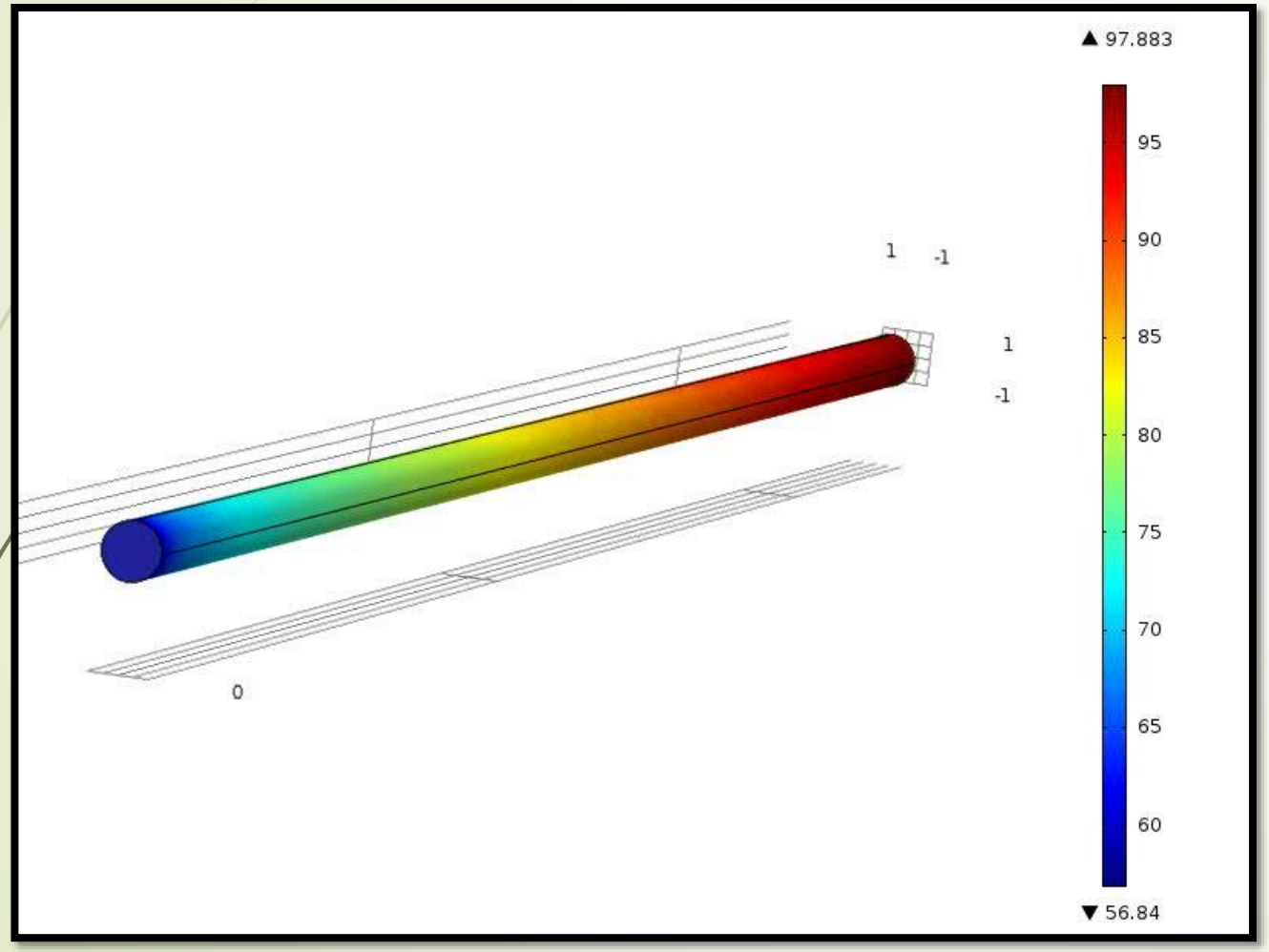
Pasteurization Process

- The counter-flow heat exchanger design will be safer for the consumer.
- Increases the efficiency by using a reheat cycle similar to those found in steam power plants.
- Relatively easy to accomplish - Stacking an identical heat exchanger on top of the photovoltaic heat exchanger.
- Increased flow rate – More water could be pasteurized over time.
- Decrease the size of the pasteurization sausage



Speaker: James Harrell

Pasteurization –COMSOL Analysis



- One Pasteurization sausage will increase temperature from 55°C to about 97°C
- This concludes that one pasteurization sausage will be adequate

Speaker: Morgan Bublitz

Heat Exchanger Test Plan

- *Testing environment was the Energy and Sustainability Center (ESC)*
- *Collect data using the Solar Simulator*
- *Run water through for 10-15 min*
- *Measure Inlet and Outlet Temperatures*
- *Measure Flow Rate*
  - *Adjust flow until desired temp occurs*

Speaker: Morgan Bublitz

Heat Exchanger Results

- *Preheated the water from 25 to 45 Deg C*
- *Cools water from 100 to 50 Deg C*
- *Ran water through the system for 20 min*
- *Measured flow rate was approximately 0.08 gal/min*

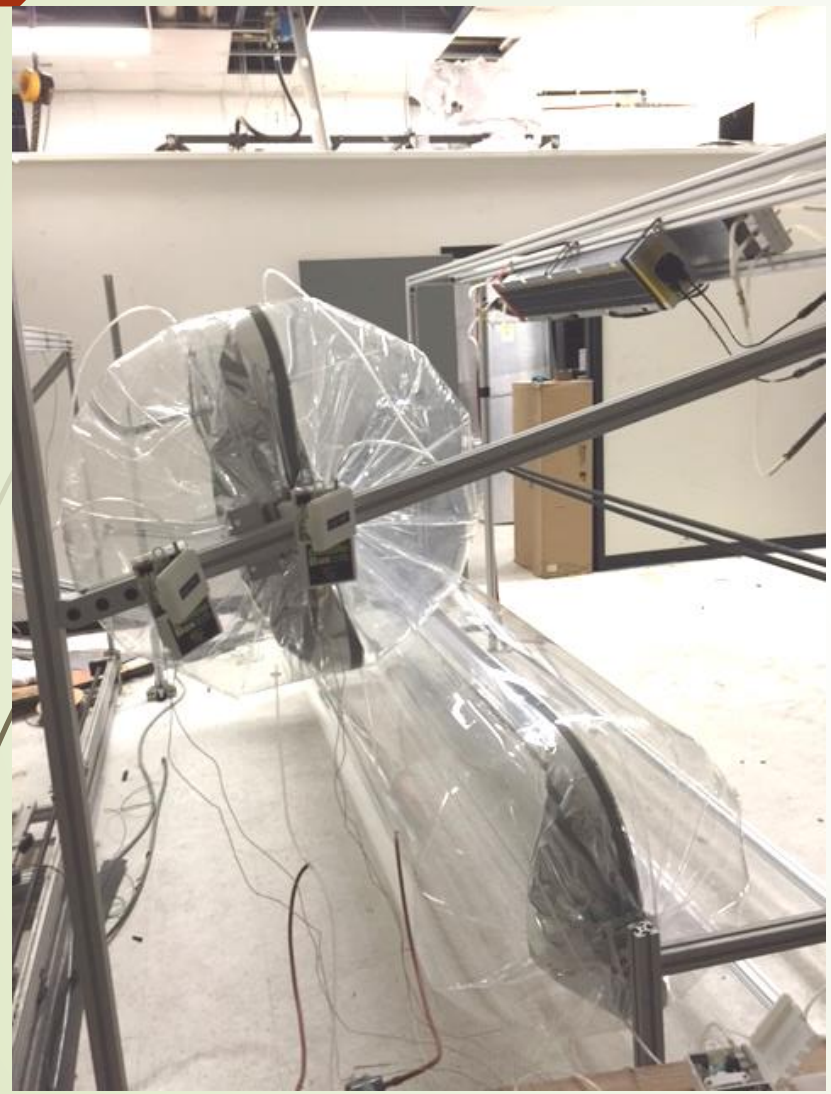
Speaker: Morgan Bublitz

Heat Exchanger Stand

- Aluminum Frame
- Angle of the solar sausage can be adjusted by moving the height of the stand.
- Heat exchanger attached behind the PV panel

Speaker: Brian Chibudu

Heat Exchanger Stand Results

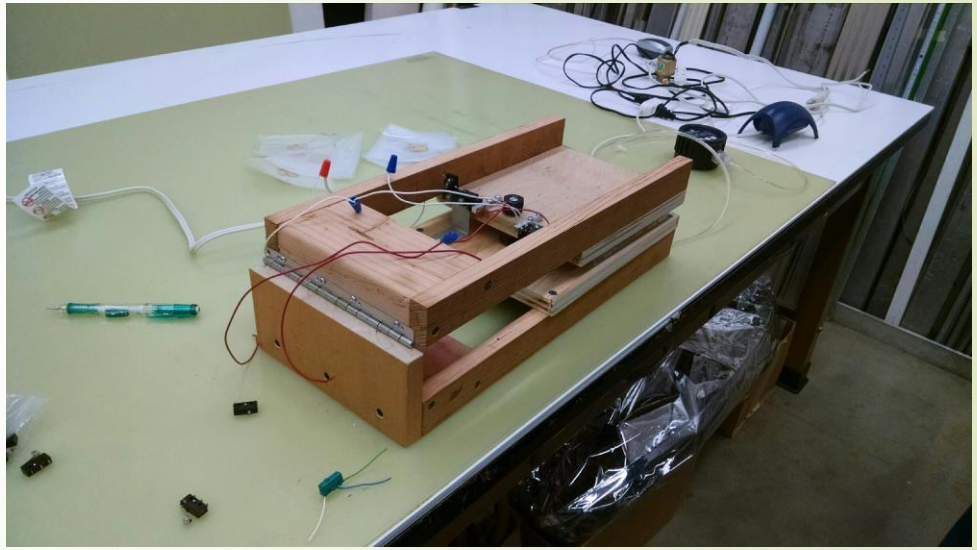


- Aluminum 8020 Frame
- The height of the stand is 6 feet
  - Width is 12 feet
- Heat exchanger is attached to the top side of the stand at a 20 degrees.
- PV panel is attached in front of the heat exchanger
- During testing, a failure of the adhesive on the ends of the heat exchanger failed
  - A different method of closing the ends would be necessary

Speaker: Brian Chibudu

Pressure Regulator Test Plan

- Test date was February 27th at 2:00pm
- Location: Keen Lab
- Objective is to verify the performance of the pressure regulator
- Sausage will then be cooled until below min pressure occurs
  - Sausage should inflate to desire pressure

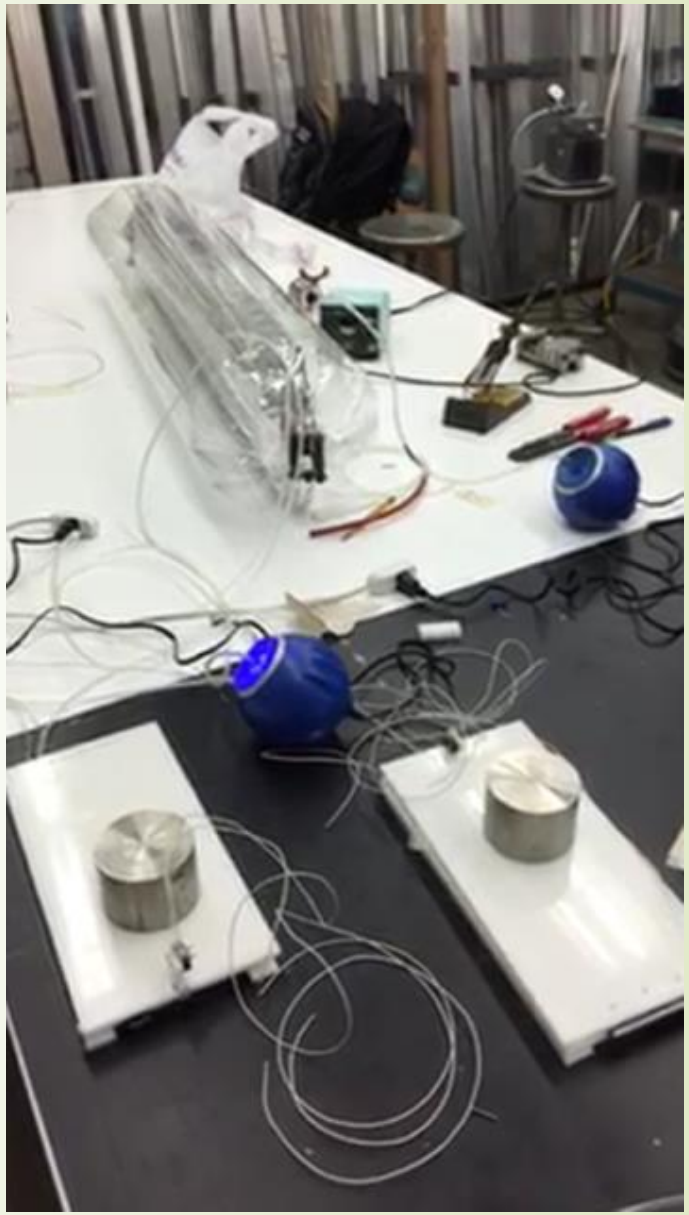


Speakers: Brian Chibudu

Pressure Regulator Plan

Performance Results:

- The upper half of the solar sausage will have pressure of 0.25 psi.
- The lower half will have a pressure of 0.245 psi.
- A differential pressure of 0.005 psi should be maintained at all times.



Speaker: Brian Chibudu

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Pasteurization Sausage Failure

Results:

- After 10 minutes excessive heat caused adhesive failure.
- Surface temperature was over 50 deg C
- Future prevention could include
  - relief valves
  - Higher temperature adhesive
  - Solenoid valves to regulate high pressure

Speaker: Morgan Bublitz

Future Work

- Buy or build custom PV panels
- Modify heat exchanger
  - Weld manifold caps
  - Better interface
- Modify pressure regulator to be more precise
  - Use micro-switches with better tolerance
  - Possibly include microcontroller and digital pressure gauges
- Implement automatic tracking system
- Implement smart flow system for optimal heating

Speaker: Morgan Bublitz

Budget

Expenses			
Item	**Quantity**	**Cost**	**Total**
Water Pump	1	$102.00	$102.00
Aerator Pump	4	$8.00	$32.00
7A Charge Regulator	1	$35.00	$35.00
12V Battery	1	$38.00	$38.00
DC Fan	1	$15.00	$15.00
ME- Materials	1	$982.00	$982.00
ME- Materials	1	$1,300.00	$1,300.00
	Expense Total		**$2,504.00**

Speaker: Aileen Ulm

Acknowledgements

- A special thank you to all who contributed, ideas and resources, to our project.
  - Ian Winger (Sponser)
  - Dr. Ordonez (Advisor)
  - Dr. Edrington (Advisor)
  - Dr. Frank
  - Dr. Devine
  - Dr. Gupta
- We've learned a lot throughout this project and would like to see it go on next year.

Speaker: Brian Chibudu