250711 Meeting Minutes

Attendees: Linda Mondaca, Alyssa Player, Jaasiel Alvarez, Annie Lam, Dennis Ko, Tasha Cammidge, Luisa Segovia, Maddy Adolph, Olivia Finney, Vijaya Kumar, Xiaohui Li, Emily Shi, Bhakti Ahir Ahir, Maxie, Aarohi Patel, Ameerah Saliu, Tatiana Solovenia, Andrew Chang, Raj Mukkamala, Darshana Marathe, Tanumoy Dhar, Chris Kalaw.

- This month, RSVP here to order food from Mendocino Farms Catering Menu! In your RSVP, please type in your preferred food order. **The deadline for submitting your food order is Thursday 9am.** I will also bring a kettle so we can boil hot water and I will bring some yummy hot chocolate packets and tea bags for folks to enjoy! If you prefer, BYOT. **Please remember to bring your laptops.** For bonus sustainability: folks can bring their own cups and/or utensils and/or plates as an alternative to our usual compostable ones!

Will update Restaurant Guide and our Coffee, Breakfast, and Dessert Guide

Introductions …

Million Advocates for Sustainable Science Petition

- International Institute for Sustainable Laboratories (I2SL) along with My Green Lab are petitioning to change funding granting agency policy to promote sustainable research
- By signing the letter you can help transform how science funding organizations set expectations for efficiency, resiliency, and sustainability in the way scientific research is conducted
- Reached 1100+ signatures!

Green Labs Monthly Tip: Sustainable Procurement (skipped due to time constraints)

1. Great resource from the EPA "Environmentally Preferable Purchasing Program"
    a) Tools to help identify greener products and services including recommendations of specifications, standards, and ecolabels
    b) Why buy Greener products?
    c) Helpful Guide to greener products and services for purchasers
2. ALSO:
3. Check out the resources on our Clean Up Event page on specific topics to help keep your lab organized and efficient, including recycling signage, chemical inventory spreadsheets, mock order sheets, or sustainable products list.
4. We are also making available digitally fillable inventory sheets or blank printable inventory sheets for freezer inventories. We recommend laminating these sheets or putting them in a sleeve protector to keep them clean and legible.
5. You can search for or divest lab items such as surplus supplies, chemicals, equipment, furniture, and more with our new (beta) Green Labs Marketplace!
6. Check out our Lab Spring Clean Event webpage for more tips and tricks to keeping your lab safe and clutter-free!

Updates

- **26 Certified labs!! WHOOOOO**
    - Please get CERTIFIED TODAY! To get certified, finish the easy, 30-minute Green Labs Certification and submit it to sustainability@caltech.edu.
    - Certified Labs-exclusive event planned for April!

Updates – Pilot Programs

- FUNDING IS AVAILABLE – SEE PILOT PROGRAMS WEBSITE
    - Lomi Composter Pilot (8 on campus): 1239 lbs of dirt (or 6195 lbs food waste)
- Pipette Tip Box Recycling: 2,775 pounds (5842 gallons or 22,113+ liters) of plastic waste diverted EXPANDING PROGRAM!
- -70˚C/-80˚C Comparison Pilot: 5 labs involved, collaborating with NIH and UVA + Norway labs collaboration
- PolyCarbin: Initial order replaced 31 pounds of crude oil and reduced 122 pounds of CO2E via sustainable procurement
    - AP: sent off another box of coloured plastic, 34 lbs of plastic recycled, 12,793 water conserved, 70 lbs carbon emissions reduced
- Styrofoam recycling pilot
    - DIVERTED 30 DUMPTSTERS total!!
    - Sign the petition!
    - Technical bulletin from I2SL
    - LCA of Styrofoam
    - How to do LCAs
- Fume hood sensor project
    - Around $1,300 savings per fume hood on average!! GG writing up now for our 21 fume hoods
- **Grenova pipette tip washer:** looking into funding options!
    - Survey for pipette tip types, cost per year, etc. to gather data
    - Looking into funding options
- **Follow us on Instagram** →
- Marketplace
    - Flow Cytometry Lab SHOUTOUT! Especially Maddy Adolphs…!!
        - Picked up supplies from two biotech companies that have shut down in recent months and diverted those supplies to labs at Caltech
            - Their lab claimed $15,026 worth of supplies from those labs!
            - Posted supplies on Marketplace:
        - TOTAL OF $35,081.07 since March 2025….

Updates – Past Events

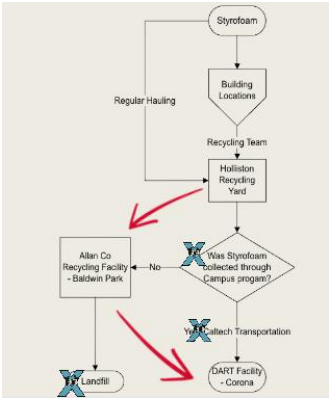
- July 2– Styrofoam recycling day
    - Changed location of Chen dropoff to 3rd floor
- Clean Up Event January – April 2025
    - Updated website! ☺
- New Marketplace webpage!
    - Over 100 entries…
        - Changed location of Chen dropoff to 3rd floor
- 2025 Freezer Challenge Jan. – July 1 2025
    - 3 LABS SIGNED UP!! Will share results soon!! (only 1 last year..!)

Updates – Future Events

- Re-Engagement Certified Labs Competition Begins in ~August!

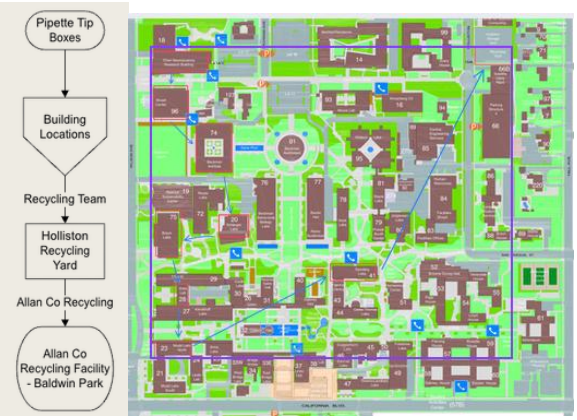
- Hosting SURF summer students – Dennis Ko
    - Plug load project
    - Fume hood project
    - Volunteers?
- Book a day for the Clean Up party?!

Presentation from Chris Kalaw with some recycling programs updates!

- Styrofoam update
    - We have purchased a new bin and bin cover for Crellin to use in Styrofoam collection
    - As the program expands within the next month, we will look to purchase similar bins for those areas
    - 40"L x 32" W x 34.5"H
    - New bin for Crellin with a cover – can use this discounted cost as leverage to purchase more for campus if needed
    - This bin needed to fit in the loading dock and be covered, and suitable for Styrofoam so took a while to find one in our budget
    - We are in the discussion phase of looking to expand the Styrofoam program with different users on campus.
        - Confirmed DART facility is at max capacity ⟶ Looking at Foam Zone in Ontario to be our new hub
            - Hopefully allow us to expand
            - Reduce transportation load
            - Streamline recycling yard
                - Want to put in a 40 yard bin to recycle more, currently the Holliston yard has a lot of wasted space, so need to make it work with the 40 yard bin by consolidating some of the wasted space that is used to store things ineffectively right now
        - 

    - Pipette tip box waste
        - We want to consolidate our recycling in house instead of through vendors allowing:
            - Current use of pipette tip boxes and pipette tips based on lab preference without environmental harm
            - New recycling stream
            - Need to maximize space in Holliston Recycling Yard

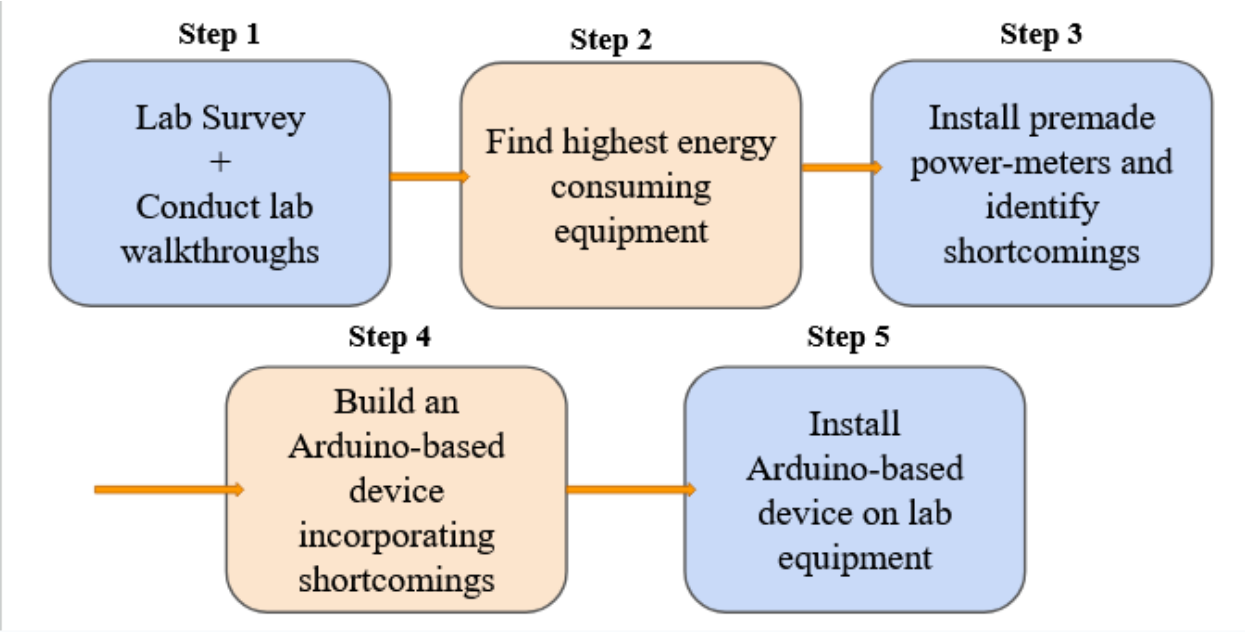
        - Increasing Recycling Team responsibilities + sorting
    - Need to make a work order – TC offered to help him create one
    - See schematic below for workflow and locations currently serviced!



    - TS: what is the timeline?
        - CK: soon! Just need to make a work order, but CK will reach out when that is all in place and approved, should be soon
    - LM: can we recycle pipette tips?
        - TC: not right now, just the boxes – tips are more complicated as they can have biological waste, they are sharps etc, - there are some waste streams we can investigate that would allow us to recycle the pipette tips!
    - JA: are the bins currently accepted by weight or volume?
        - CK: volume
    - JA: might we worthwhile to break down boxes because there is a lot of wasted space and many are not able to be leafed together, something to consider moving forward
    - JA: can any brand be used or do they need to be approved?
        - CK: may need approval but should all be treated the same from our end as it is all the same type of plastic
        - CK: currently have checked several brands including Rainin, Genesee, USA Sci, etc. but may need to examine other brands before expanding to them too
    - LS: many labs store lots of extra boxes, especially since we heard this expansion is happening soon, so at first you may have to stop by more often than what is scheduled and you may have an exaggerated volume to start
        - CK: will keep that in mind, and will monitor to see if weekly, biweekly, or monthly is needed at each location
    - VK: do any companies have takeback programs? That would be the best way to circularize this waste stream, currently our vendor does use the boxes they pick up in different labs, then drives the rest of the waste to a location in SD close to their home…
        - CK: could use marketplace to do this?
- Reach out to Chris at ckalaw@caltech.edu and follow on Insta @caltechgreen!

Presentation by Aarohi Patel on Adaptive Energy Monitoring and Automation System for Research Labs at Caltech – see slides in Drive

- What is the problem?
    - Labs at Caltech spend lots of $$ per year
    - 75% of those costs come from research labs
        - For example: One ULT freezer = the same energy as one home each day



- Step 1: lab survey and conduct lab walkthroughs
    - Developed survey (may have seen signs!)
    - Survey labs to see what equipment they have and calculate the kWh/day based on their responses for how long each piece runs for
    - During physical walkthrough take information on equipment type and write down voltage, amps, watts etc of each piece of equipment
- Step 2: find highest energy consuming equipment
    - Find high-energy consuming equipment and also examine less-high energy consuming equipment and develop a strategy for reducing the energy consumption
- Step 3: install premade power meters and identify shortcomings
    - 2 models:
    - First: clamps around the cord of the machine, does not have real-time data and only tracks energy usage
    - Second: plugs into the machine and tracks real-time data, and has a timer included that you can control on an app – BUT lab managers may not want us to plug them into their expensive equipment
- Step 4: build an Arduino-based device incorporating shortcomings

Build a real-time energy monitoring and automation system using Arduino and microcontrollers → **E-Mon**

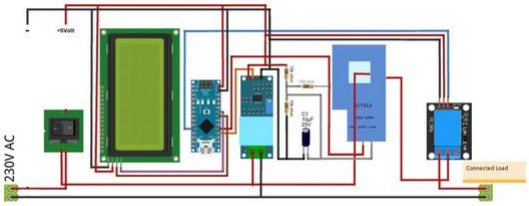


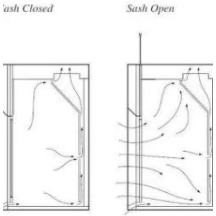
Figure 1: *A schematic for the E-Mon. It includes (from left to right) a switch, a 16x2 LCD display with an I2C module, an Arduino, ZMPT101B voltage transformer, 10k Ω and 100 Ω resistor, 10 μF capacitor, SCT-013 current sensor, 5V relay module. The E-Mon displays power usage of equipment that the current sensor is clamped onto.*[16]

- Step 5: install Arduino-based device on lab equipment
    - For things we can't install sensors onto, can take preventative measures thourh education, stickers, etc
- Timeline:
    - Week 1-4: Conduct lit reviews, lab interviews/surveys, equipment selection
    - Week 5: Begin incorporating premade device into labs and generate data. Assemble and begin testing the Arduino-based device. Establish baseline data.
    - Week 5-6: Quantify data found on premade device. Begin deploying arduino-based devices into certain labs on certain lab equipment. Begin automation programming.
    - Week 7-8: Refine shutoff logic, expand arduino-based device to other lab equipment. Continue data collection to evaluate energy savings compared to the baseline.
    - Week 9-10: Analyze final energy usage data and quantify energy and cost savings. Compile results into a final report, detailing the system's performance and potential improvements
- Questions:
    - AS: what change do you want to see? For example, if you looked at A/C?
        - AP: so for A/C that is something I can't control, but we would want to see energy reduction in labs overall, I would love to work on things like A/C or lights as they use a lot of energy, but not currently targeted
        - MC: also note that facilities has done a good job of updating the HVAC and electrical (to LED lights etc) so those are actually well-controlled and facilities has taken advantage of those opportunities already, but upgrading equipment and especially lab equipment is untapped
    - JA: as a way to encourage users, you could incorporate real time monitor to look at voltage sagging that could damage equipment or monitor brown-outs etc
    - OF: if the power goes out could also notify users via text?
    - M: how much energy does the chip consume, especially if connected to wifi?
        - Needs power but not battery, might make it more useable if battery but plugging in also good

Presentation by Bhakti Ahir Ahir : Enhancing Motion and Sash Height (MASH) Alarms to Increase Fume Hood Energy Efficiency

- Background
    - 40-70% of all energy at Caltech goes to labs
    - Each fume hood costs $6-9k to run per year, more if they are left open
    - 713 fume hoods at Caltech – costs us $4.9-6.5M per year
    - 113 have sensors (only 16%)

- CAV vs VAV
    - Constant Air Volume
        - Maintain same airflow
        - Sash height - no impact
    - Constant Air Volume
        - Maintain same airflow
        - Sash height - no impact



- Previous work
    - Mit saw a 75.6% decrease in average sash height as compared to control groups that did not have a MASH sensor installed
        - This resulted in energy cost reduction of roughly $1,159 per fume hood
        - MASH sensor costs around $20-$50 each,
    - 2024 intern Genevieve installed similar sensors to Caltech

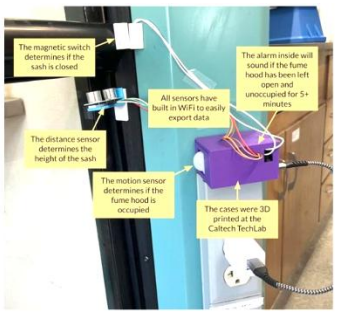


Figure 2. Previous work done by Genevieve Gandara depicting the fume hood sensors launched at Caltech in the summer of 2024 [6].

    - She saw a $1300 savings per fume hood! $30,000 over a year with 22 sensors installed!
- Problems: not all fume hoods are created the same
    - Outlet location affects sensor positioning
    - Some fume hoods have slanted or tilted frames
    - Some are “ideal” such that the sensor and everything else aligns
    - Dashboard Genevieve used was Adafruit – sensors stops sending data if there is a power outage (every month every building has a safety shutdown, so no data after that) 😟
- 2024 model aims to deal with a lot of these issues
    - Want to have several models that can be added to each variant of the fume hood and make sense, and will need to redesign 3D printed enclosure
    - Since already redesigning the sensor, also want to update the Arduino to another ESP32 controller, this will help with data export AND is smaller AND is more energy efficient

    - Also updating from Adafruit to InfluxDB (to collect data) /Grafana (to visualize data)
    - Want to get rid of the reed switch – redundant with the height sensor
- Experiment with warm water and dry ice, which makes CO2, want to measure how much exposure people will get with the sash at various heights, as an extra way to justify the closing of the sash from a safety perspective
- Want to have a notification system to let users know if they've walked away (the idea being that the sensor will not beep for 5 mins, but they may not hear if they are already walking home, so the notification system will go to their phone then they can come back and turn it off)
- Questions:
    - MA + OF: we have one, do we expect an upgrade?
        - BA: YES! Also want to ask about your experiences with it, will send out a form soon to get that

<u>For next time:</u>

- Want to investigate what we need to be sustainable purchasers, so consider and come prepared to discuss:
    - What questions can we ask vendors to ensure we are *actually* purchasing sustainably?
    - What do YOU need to make sustainable decisions?
    - What questions can YOU ask to ensure companies are not greenwashing?
    - What things should we search for during our own research?
- Next meeting Aug 8!!

<u>Discussion about Sustainable Procurement – for next time!</u> Think about these questions, do your own research, and discuss next time!

1. What questions can we ask vendors to ensure we are *actually* purchasing sustainably?
2. What do YOU need to make sustainable decisions?
3. What questions can YOU ask to ensure companies are not greenwashing?
4. What things should we search for during our own research?
    a. "company name" + "investor relations"
    b. Look for dedicated sustainability sections or reports on company website
    c. Annual sustainability reports with goals, actions, progress (can be integrated into financial reports)
    d. Look for certifications like Energy Star or LEED as inticators of commitment, or other reputable organization certification for specific sustainability practices
    e. Check for waste management/reduction strategies, waste audits, recycling programs, efforts to minimize waste generation
    f. Resources:
        i. United Nations Sustainable Development Goals
        ii. Library of Congress Research Guides on Green Business Standards and Certifications
        iii. Carbon Disclosure Project – environmental data on companies

iv. ESG Manager (Global Socrates) – database providing environmental, social, and governance data on companies
v. Cornell CSR and Sustainability Lists

5. Updates to TechMart?
    a. Restricted commodities?
    b. Product lists?
    c. 3rd party verification requirements? (ACT label thresholds?)
6. Marketplace…
    a. Swap meets?
    b. Storage?
    c. Lab cleanout resources?

Updates from Clean Up Event

7. REALLY cool responses! Saw 7 labs participate, each one did some very cool things
8. Highlighting the Flow Cytometry Group, who found some awesome things and shared a slide deck of their clean up!
9. TC: will update the website with new photos, but 2 labs asked for an extension so will wait until the 16th to post them 😊

I2SL LabSavers Initiative

10. I2SL used our program and CU Boulder's program to make an online resource, and they would like feedback. Since we just did cleanups, is anyone willing to read through and provide them feedback?
    a. JA: sure!
    b. TC: will post in minutes and in email on Monday

OK, see you next time August 8 and excited to hear Green Labs SURF students!