



EQUITABLE SOLARSM
SOLUTIONS



ACEP
Alaska Center for Energy and Power

Reuse Equipment Can Support Your Research and Create Value for You Community

RICH STROMBERG / EQUITABLE SOLAR SOLUTIONS

Used solar panels

Would have been thrown in landfills

We help those in need



EQUITABLE SOLAR
SOLUTIONS



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What can Haiku teach us?

Haiku is a form of Japanese poetry known for both its constraints and its impact. It's a revered and historic art form for good reason: You'd be surprised how much meaning you can pack into 17 syllables.



Why Constraints Are Good for Innovation

by Oguz A. Acar, Murat Tarakci and Daan van Knippenberg

November 22, 2019



hbr.org/2019/11/why-constraints-are-good-for-innovation



Recent surveys show that managers tend to consider compliance restrictions and a lack of resources as the main obstacles to innovation. This common wisdom suggests eradicating all constraints: by getting rid of rules and boundaries, creativity, and innovative thinking will thrive. Our research, however, challenges this wisdom and suggests that managers can innovate better by embracing constraints. We reviewed 145 empirical studies on the effects of constraints on creativity and innovation, and found that individuals, teams, and organizations alike benefit from a healthy dose of constraints. It is only when the constraints become too high that they stifle creativity and innovation.



ordinarymastery.substack.com/p/mastery-haikus-experimenting-with



Deliberately imposing constraints on the creative process often leads to interesting results. In music, for example, one could limit the range of sounds, instruments, and harmonic, or melodic variety. Think of the raw stripped-down funk sound that emerged from the musical constraints imposed by James Brown. Or the productions that emerged in 60s rock music when studio engineers were constrained by the limits of four-track tape recording, yet still achieved layers of sound and experimental edits through creative recording ingenuity. Or consider the astonishing fretting speed, style and accuracy of gypsy jazz guitarist Django Reinhardt, constrained to use his only two functioning digits to create licks that leave the hands of full-fingered guitarists falling over themselves.



Django Reinhardt forced himself to reinvent and regain his guitar mastery after his 4th and 5th fingers were badly damaged in a fire.

Common constraint: Lack of funding

Many federal funding opportunities over the past 3+ years.

Even so, competition for these funds can be fierce

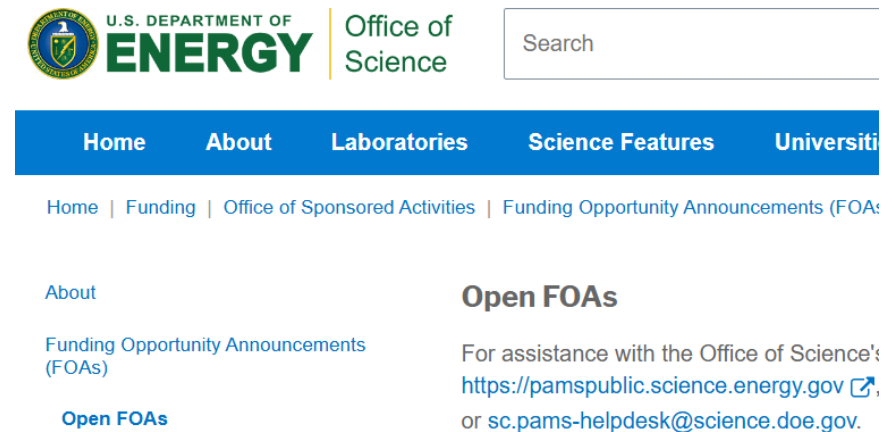
- Dearth of prior funding
- Lots of great new ideas and teams

Research federal, state and private sources

- Who has been awarded funding, scope of work, funding amounts
- Target funding sources with the best fit

We may be entering a new era with fewer available funds

Keep applying but in the meantime, consider...



The screenshot shows the top portion of the U.S. Department of Energy Office of Science website. At the top left is the DOE logo and the text "U.S. DEPARTMENT OF ENERGY" and "Office of Science". To the right is a search bar. Below this is a blue navigation bar with links for "Home", "About", "Laboratories", "Science Features", and "Universiti". Underneath the navigation bar is a breadcrumb trail: "Home | Funding | Office of Sponsored Activities | Funding Opportunity Announcements (FOAs)". The main content area is split into two columns. The left column has links for "About" and "Funding Opportunity Announcements (FOAs)", with a sub-link for "Open FOAs". The right column has a heading "Open FOAs" followed by text: "For assistance with the Office of Science's <https://pamspublic.science.energy.gov>, or sc.pams-helpdesk@science.doe.gov."

Older equipment models

The screenshot displays the LabX website interface. At the top, there is a search bar with the text "Search New & Used Lab Equipment, Consumables & Supplies" and a shopping cart icon indicating "0 ITEMS - \$0.00". The navigation menu includes "CATEGORIES", "APPLICATIONS", "PRODUCTS", "MANUFACTURERS", "RESELLERS", "NEWS & INSIGHTS", "WEBINARS", and "AUCTIONS".

On the left side, there is a "Learn More" button and a section for "UPCOMING AUCTIONS" featuring an "Online Auction - Nov 19-21, 2024 Immunology Research Equipment Auction" with a "Click Here to View Lot Catalog" button. Below this is a "FEATURED" section for SARTORIUS, highlighting "Transform Biologics Development with" and an image of a DNA helix.

The main content area is a grid of equipment listings:

- SARTORIUS:** "Superior Cleanability, Scalability and Flexibility. High-Performing TFF Cassettes. Shop Now".
- Certified GenTool Inc:** "With a savings of over 50-80% off a new instrument, who wouldn't want to buy used. Certified Pre-owned Laboratory Equipment! Shop Now".
- ThermoFisher Scientific:** "Precision, Speed, and Reliable Elemental Analysis. NEW! Thermo Scientific™ ARL™ X900 XRF Spectrometer. Shop Now".
- HAMILTON:** "Standard in Precision Measurement. Hamilton Lab Syringes for Life Science and Chemistry. Shop Now".

On the right side, there is a "CLEARANCE" section with a sidebar for "Categories" (SALE, BEST SELLERS, CLEARANCE, OVERSTOCK, SHOP CATEGORIES) and "Shop By Price" (\$0.00 - \$2,558.00, \$2,558.00 - \$5,106.00, \$5,106.00 - \$7,654.00, \$7,654.00 - \$10,202.00, \$10,202.00 - \$12,750.00, Reset). The main area shows a grid of clearance items:

- USA Lab Recertified - USA Lab UL Listed 21CFM UVP-21 Corrosion Resistant 2-Stage Vacuum Pump. MSRP: \$3,099.00. Now: \$2,324.99.
- AirClean Systems Shortwave UV Light Box for Surface Decontamination. MSRP: \$2,195.99. Was: \$2,195.99. Now: \$1,647.00.
- USA Lab 200LB Jacketed Solvent Tank w/ Sight Glasses, Casters, & 1.5" TC Drain (200LB Water, 96LB Butane). Was: \$2,499.00. Now: \$1,599.00.
- CODA Tower ECO 4 Stage Air Filtration and Purification Unit. Was: \$1,899.00. Now: \$1,424.00.
- USA LAB Mechanical Stirrer DJQ-90. Was: \$949.00. Now: \$712.00.
- Q-Lab Water Repurification System. Was: \$949.00. Now: \$712.00.
- mke Vacuum Isolation Valve - Low Profile 2-stage Soft Start. Was: \$649.00. Now: \$699.00.
- Edwards Outlet Mist Filter MF 100. Was: \$449.00. Now: \$337.00.

Can still learn techniques and methods even when older equipment lacks the latest precision
Each technique has a learning curve – you can advance up that curve with previous generations
These can still be out of your budget, so consider...

Cheap equipment from overseas

They may not last 20 years but even name brand, high end equipment will probably be obsolete in 3 years. Plus, you may only need the tool for a year or two until you graduate.

The image shows a screenshot of an online marketplace with two main sections. The top section is a search results page for 'spectrum analyzer' on TOMTOP. It features a search bar with the text 'spectrum analyzer', a search button, and navigation links like 'Sign In' and 'Favorites'. Below the search bar are filters for 'Shop By Departments', 'New Arrivals', 'Flash Deals', 'Coupons', 'Social Savings', and 'Clearance'. The search results are sorted by 'Featured' and show three items: 'SA6 Portable Spectrum Analyzer Signal Generator 3.2 inch Touched Screen' for US\$186.99 (40% off), 'tinySA Portable Spectrum Analyzer Handheld 100k-5.3GHz High Frequency Signal Generator' for US\$152.99 (36% off), and 'ZQ6 Spectrum Analyzer with R. Signal Source and Tracking So' for US\$218.99. The bottom section is an AliExpress product page for the 'HT-18+ Handheld thermal imager'. It features a large product image, a price of \$193.55 (16% off from \$230.94), and a 'Save \$37.39' badge. The product specifications are listed: Infrared Pixels: 256x192, Visible Light Image: 640x480, Measuring Range: -20 ~ 550°C, and Image Frame Rate: ≤25Hz. The page also includes a 'Follow Store Add to Favorites' banner, a 'Save Time Save Money' banner, and a '5.0 1 Review | 6 sold' rating. The bottom of the page features a 'UP TO 50% OFF' banner with '1 DAY Fast Delivery' and '1 YEAR Quality Assurance'.

TOMTOP
Loving · Shopping · Sharing

English | All | spectrum analyzer

Switol Laser Engraver, Electric Bikes, 3d Printers, Solar Generator, Laser

Sign In | Favorites

AliExpress | hpcs 330p

Shop By Departments | New Arrivals | Flash Deals | Coupons | Social Savings | Clearance

Home > "spectrum analyzer" 3 results

Sort by: Featured | Newest | Most Popular | Most Reviews | Price

All
Test Equipment & Tools (3)

WareHouse Options
 CN(3)

Featured Options
 On Sale(3)
 24 Hours Shipping(2)

Price
 More Than US\$100.00(3)

SA6 Portable Spectrum Analyzer Signal Generator 3.2 inch Touched Screen
US\$186.99
US\$308.99
❤️ (211)

tinySA Portable Spectrum Analyzer Handheld 100k-5.3GHz High Frequency Signal Generator
US\$152.99
US\$235.99
❤️ (189)

ZQ6 Spectrum Analyzer with R. Signal Source and Tracking So
US\$218.99
US\$348.99

Follow Store Add to Favorites
Save Time Save Money

HT-18+ Handheld thermal imager

Infrared Pixels: 256x192
Visible Light Image: 640x480
Measuring Range: -20 ~ 550°C
Image Frame Rate: ≤25Hz

Image display
Accurate temperature measurement

UP TO 50% OFF
SAVE MORE WITH COUPONS

1 DAY Fast Delivery
1 YEAR Quality Assurance

Save \$37.39

\$193.55 ~~\$230.94~~ 16% off
Tax excluded, add at checkout if applicable. | Extra 2% off with code

up to 4x \$48.39 with no interest

HTI HT-18 Plus Infrared Thermal Imager Camera 2!
Construction Repair PCB Detection Temperature M

★★★★★ 5.0 1 Review | 6 sold

Color: HT-18 Plus (256X192)

Used equipment (purchased or donated)

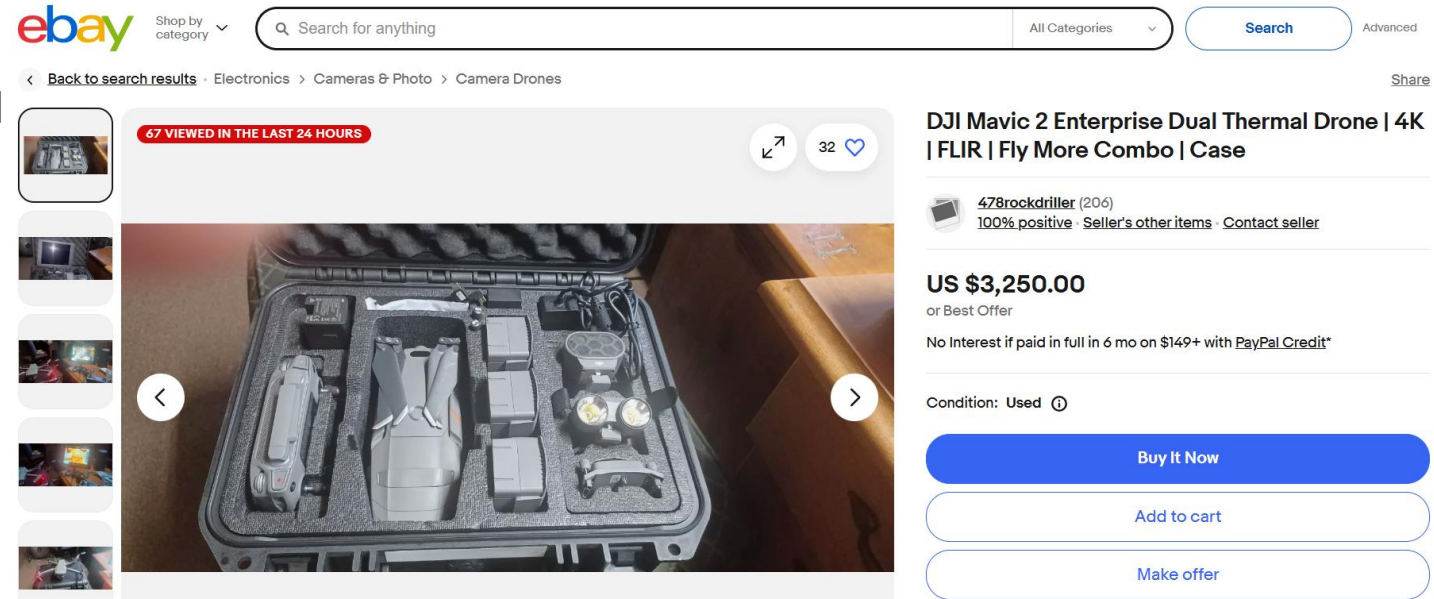
Lots of stuff on eBay

- Learn what the market rate is for some of the used equipment.
- Find out which brands fetch a premium price and which don't.

Write to companies that already use the same type of equipment and find out if they are considering an upgrade to a newer model.

- They might be willing to donate old equipment to your university.
- Or partner with a local nonprofit that can issue a tax donation letter on your behalf and then transfer the equipment to you.

Channel your inner MacGyver!!



The screenshot shows an eBay product page for a DJI Mavic 2 Enterprise Dual Thermal Drone. The listing includes a search bar at the top with the text "Search for anything", a breadcrumb trail: "Back to search results > Electronics > Cameras & Photo > Camera Drones", and a "Share" button. The main image shows the drone and its accessories in a carrying case, with a red banner indicating "67 VIEWED IN THE LAST 24 HOURS". To the right of the image are icons for "32" views and a heart icon. Below the image, the seller's name "478rockdriller (206)" is listed with a "100% positive" rating and a "Contact seller" link. The price is "US \$3,250.00" with the option "or Best Offer". A note states "No Interest if paid in full in 6 mo on \$149+ with PayPal Credit*". The condition is listed as "Used". At the bottom, there are three buttons: "Buy It Now", "Add to cart", and "Make offer".



Network to find people who will train you

Attend conferences in your field to build your network.

Some conferences will comp students the registration fee if you help facilitate.

Find managers and researchers working on cool stuff and volunteer to come in and assist.

Build relationships. Show your initiative. Ask people to train you.

Build it yourself

BACKGROUND

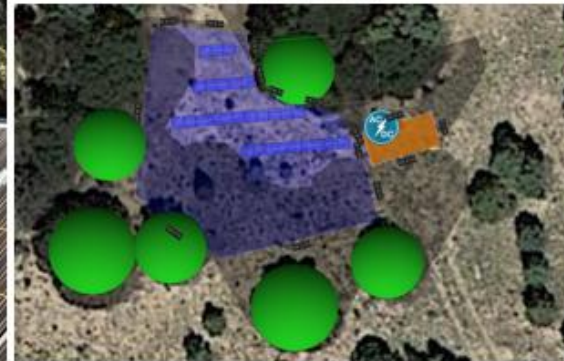
As a PhD student making sub \$30k stipend per year, every penny counts when trying to fund your research. A funding agency letter beginning "We regret to inform you..." doesn't mean you are at a standstill for conducting research. The student built the Solar Reuse Test Laboratory (SRTL) on vacant land in southern Colorado to support his work on reusing solar photovoltaic equipment for social and ecological benefit. The site includes: multiple test arrays with various defect modes; environmental monitoring; low-cost tools for thermal imaging, microscopy, colorimetry, UV fluorescence, insulation/leakage, cell temperature, irradiance, electrical performance; used equipment for EL imaging; one big-ticket I-V curve tracer; and a used 20-foot Conex with space to house equipment and supplies as well as provide dark space to conduct UV fluorescence and EL imaging. The test lab is powered by an off-grid solar PV, battery and inverter system. The site comes with sweeping mountain views and a 0.2-mile walking commute.



SRTL GUIDING PRINCIPLES

- If you have time but little money, leverage your own labor to construct the site.
- Vacant land is your friend.
- Used equipment and surplus materials work well and are diverted from the landfill.
- Tree diggers can rehome vegetation that shade arrays.
- PV modules with defects can still power the laboratory.
- Call in favors from prior pro bono work.
- Cheap, less-accurate equipment are still pathways to gain experience while coming up the learning curve of new-to-you analytical methods.
- Not all defects and performance issues require the utmost accuracy in equipment. Some problems merely require lower-resolution analytical methods.
- Brand new, high accuracy/resolution is great! That's what eventual grant funding should be spent on.

SRTL DESIGN



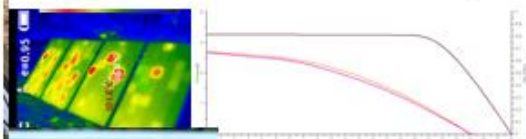
SRTL KEY COMPONENTS

- Site leveled with neighbor's skid steer.
- 20-foot Conex (used).
- Reuse tilt-up module racking.
- Unistrut and pipe mounts for PV modules.
- Reuse Sharp ND-176 modules to power the lab.
- Ready-to-assemble shelving, workbench.
- Eight module types currently under study (Kyocera 130W, SolarFun 235W, Boviet 255W, Arco 50W, Shell 110W, AstroPower 120W, Silicon Energy 195W, Sharp 176W)
- Staging area for additional modules in inventory (Photowatt 80W, Shell 80W, Lumos 185W, Suntech 175W, Shell 142W/72W, SunPower 225W, GE 100W, Trina 330W, REC 215W)
- Total cost = \$10k-\$12k out of retirement account.

SOLAR REUSE TEST LABORATORY ARRAYS



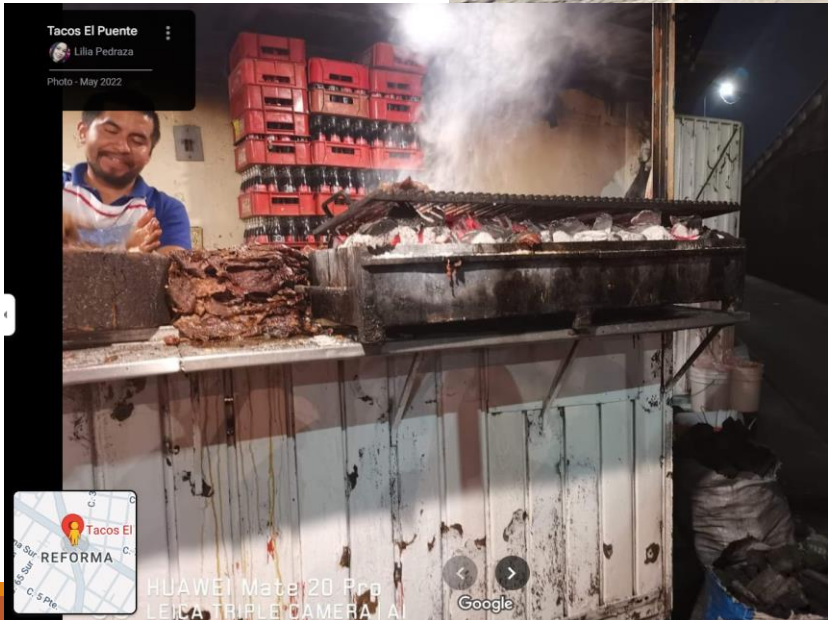
SRTL ANALYTICAL CAPABILITIES



ACKNOWLEDGEMENTS & CONTACT

Committee chair Dr. Richard Wies Jr. and committee members Dr. Diane Hirschberg, Dr. Daisy Huang, Hon. Patricia Sekaquaptewa, Dr. Meng Tao and Dr. Greg Poelzer. School of Interdisciplinary Studies at University of Alaska Fairbanks.
Contact: Rich Strömberg restromberg@alaska.edu

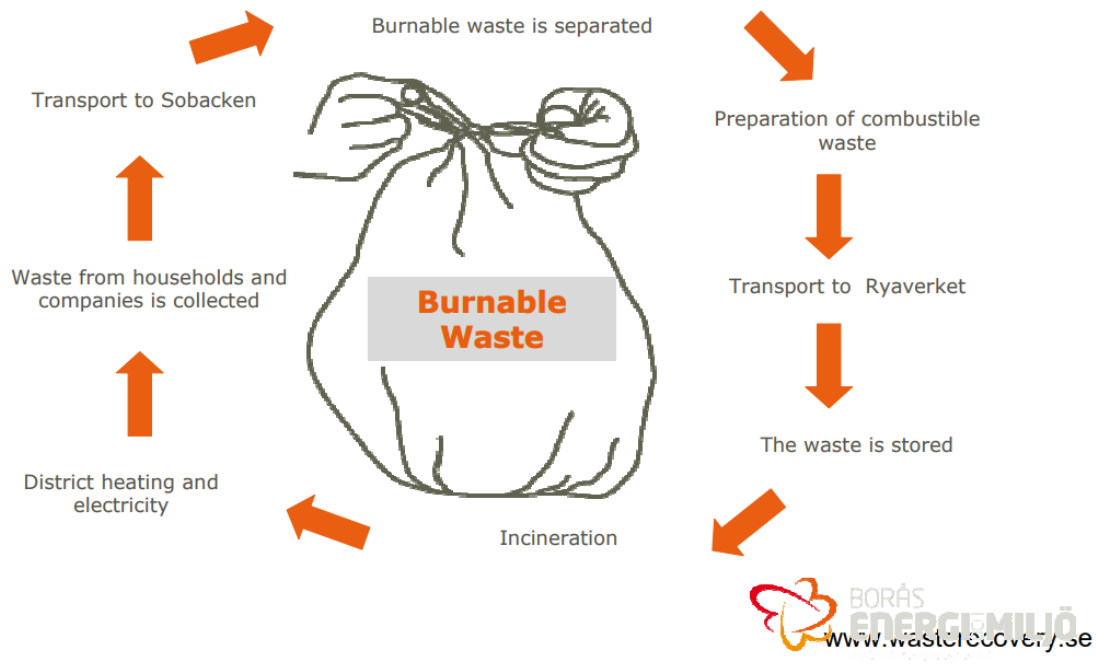
Mexico – A Culture of Repair, not Disposal



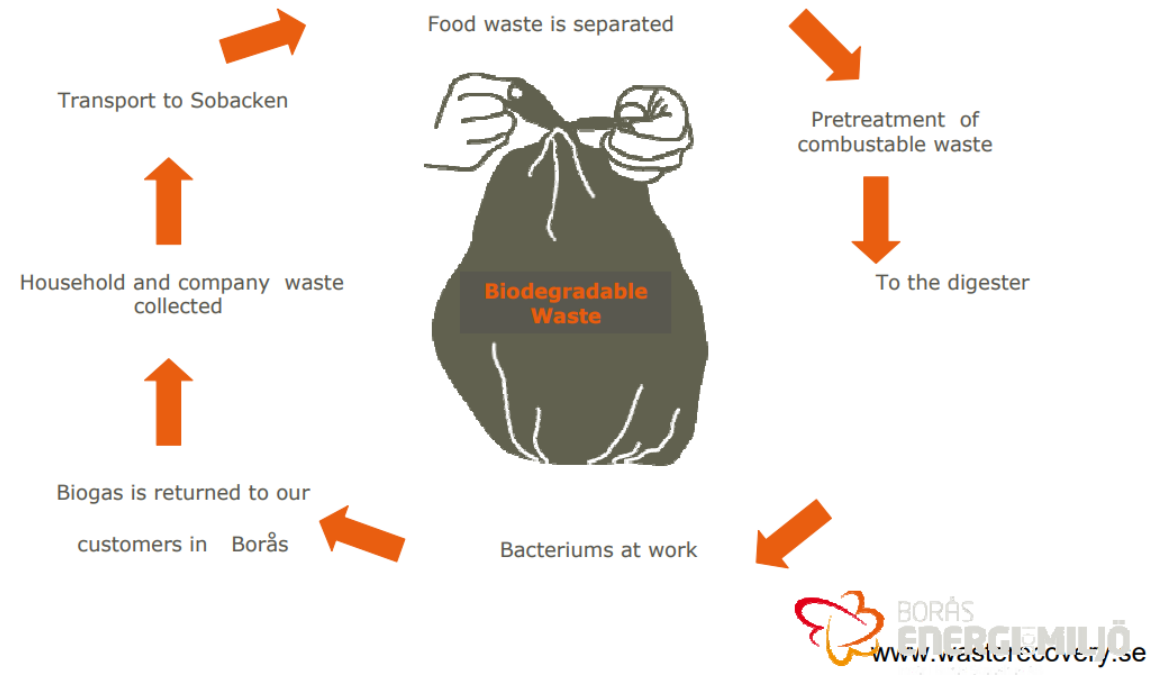
HUAWEI Mate 20 Pro
LEICA TRIPLE CAMERA

USA sees waste / Sweden sees raw materials

Burnable waste becomes district heating and electricity



Food waste becomes biogas

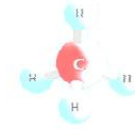


USA sees waste / Sweden sees raw materials

RYAVERKET Heat- and powerplant



Biogas production



Substrate [Ton]

• Biogradable waste - Black bags (Household Borås)	4 000
• Biogradable waste (Household suburbs)	7 500
• Biogradable waste (Commercial)	2 464
• Biogradable liquid waste (Commercial)	9 719
23683	

Gas production [Nm3]

• Raw Gas	2 546 629
• Vehicle fuel	1 123 407 (11,2 GWh)
• Methane gas for heating	308 976 (3,08 GWh)
• Residual product (fertilizer)	1982 Ton

[Amount 2009, metric ton]





Equitable Solar Solutions

From A Student Project To A
Revolutionary NonProfit Organization



Original 5 capstone students (CJ, Avery, Monty, Maria, Riley) from Western Colorado University, Clark School of Environment and Sustainability. (Apr. 2019)



ESS Constraints

Cash poor

No prior knowledge to work from

Pitch to people who don't understand the possibilities

Not NABCEP certified

Equitable Solar Solutions

ESS™

Home

Projects

About Us

Contact

Press

Research

EQUITABLE SOLAR SOLUTIONS™

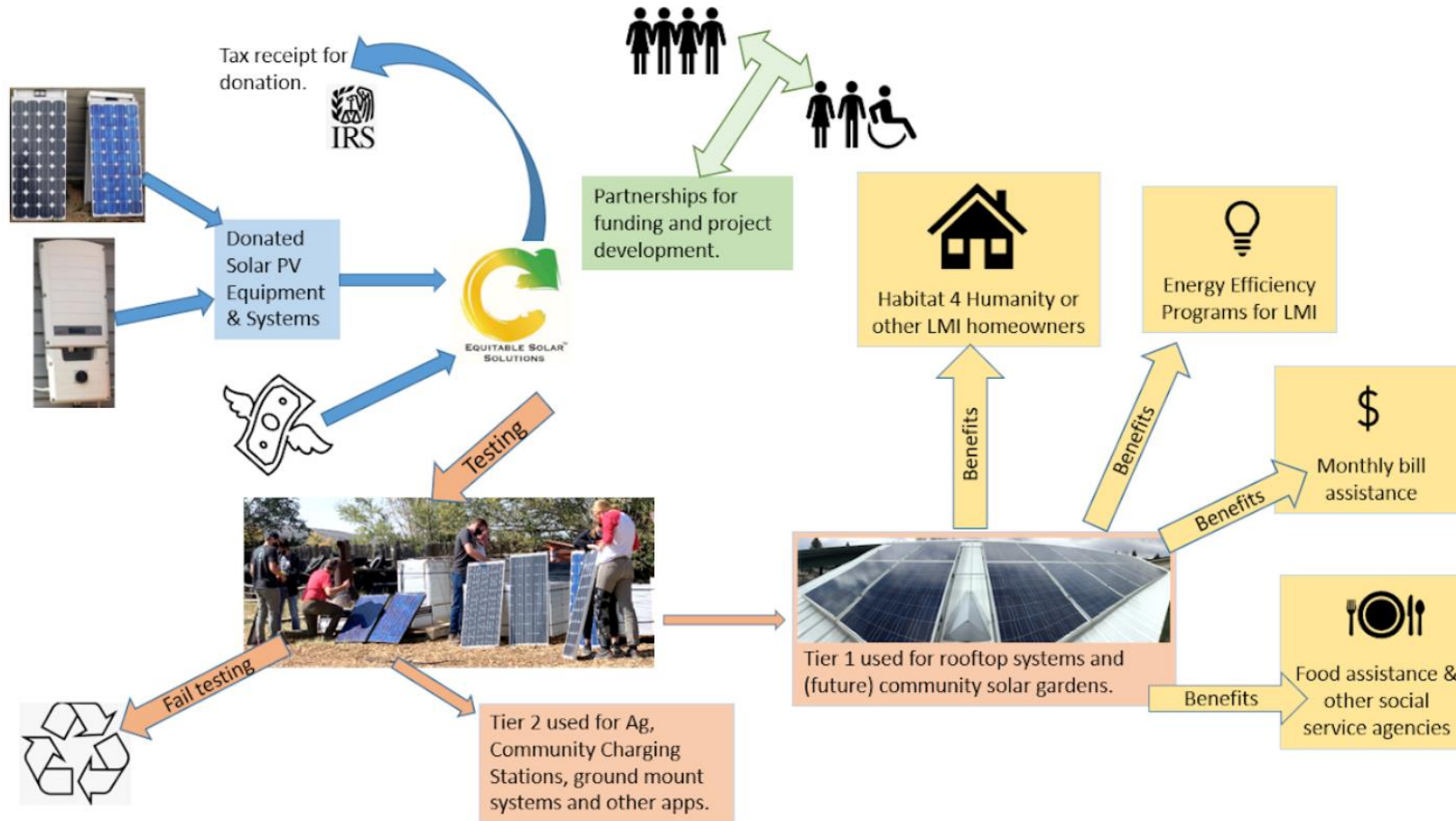


REUSING SOLAR EQUIPMENT TO CREATE THE GREATEST VALUE FOR THOSE WITH THE GREATEST NEED

The Equitable Solar Solutions™ team works to create more just and sustainable energy solutions that benefit disadvantaged communities through reuse of solar energy systems.

We are building a social equity solar energy company that creates the greatest value for those with the greatest need.

Equitable Solar Solutions



Equitable Solar Solutions



HABITAT FOR HUMANITY

Each year, ESS™ teams up with Nunatak Alternative Energy Solutions, Hearth Design Build and the Gunnison County chapter of Habitat for Humanity™ to build a 4 to 5 kilowatt solar array.



SOLAR FOR UKRAINE

For Tier2 modules that still function but don't meet our quality standards to install on the homes of our needs-based clients, we can still reuse them for agricultural purposes or send them to Ukraine to provide silent, off-grid USB charging solutions for refugees, schools, involuntarily displaced people and anyone else who needs power when the grid is down. Rotary International has been our partner in this initiative, helping to organize events to build and decorate solar chargers and pay for shipping overseas.

These chargers help people stay in touch with family and friends, stay updated on current conditions and remain connected to their online communities.



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Good intentions can harm solar reuse

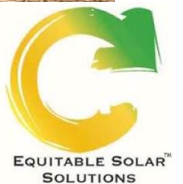
Not all solar PV equipment is suitable for reuse.

Workers instinctively want to save as many modules as possible. Equitable Solar Solutions™ uses a 3-tier system.

- Tier 1 – meets datasheet and no defects or other issues preventing 20 years of future performance. Unrestricted use.
- Tier 2 – meets datasheet but defects or other factors reduce likelihood of 20 more years of operation. Restrict use to systems operated, maintained and monitored by ESS on a daily basis. Conduct long-term research. Some defect modes may turn out to be problematic.
- Dispose/Recycle – does not meet datasheet and/or safety issue with the module.



Accept that we can't save all the modules, inverters, etc.





Takeaways

Identify your constraints and then embrace them!

Let your constraints force you to think of alternate pathways and solutions.

Find value in our “waste” streams.

Come up the learning curve on old/borrowed equipment.

Create value for people and communities with the greatest need.

Learn by doing, even if your initial methods are crude.

Be persistent. Be a little naïve.

If you don't know you're supposed to fail, sometimes you won't!

Reuse - Social License to Operate



Reuse brings new advocates to the fold that would otherwise never be able to afford solar energy.



Solar for Ukraine I → VI



Kate and Brandon D. Habitat homeowners

“It’s been really great to do so in a cost-effective way with the Habitat for Humanity process. Obviously, we don’t have a lot of excess funds. To have something like this be approachable within our reach is a dream come true.”



Questions?



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<https://www.equitablesolarsolutions.org/>

Follow us at <https://www.linkedin.com/company/equitable-solar-solutions/>

