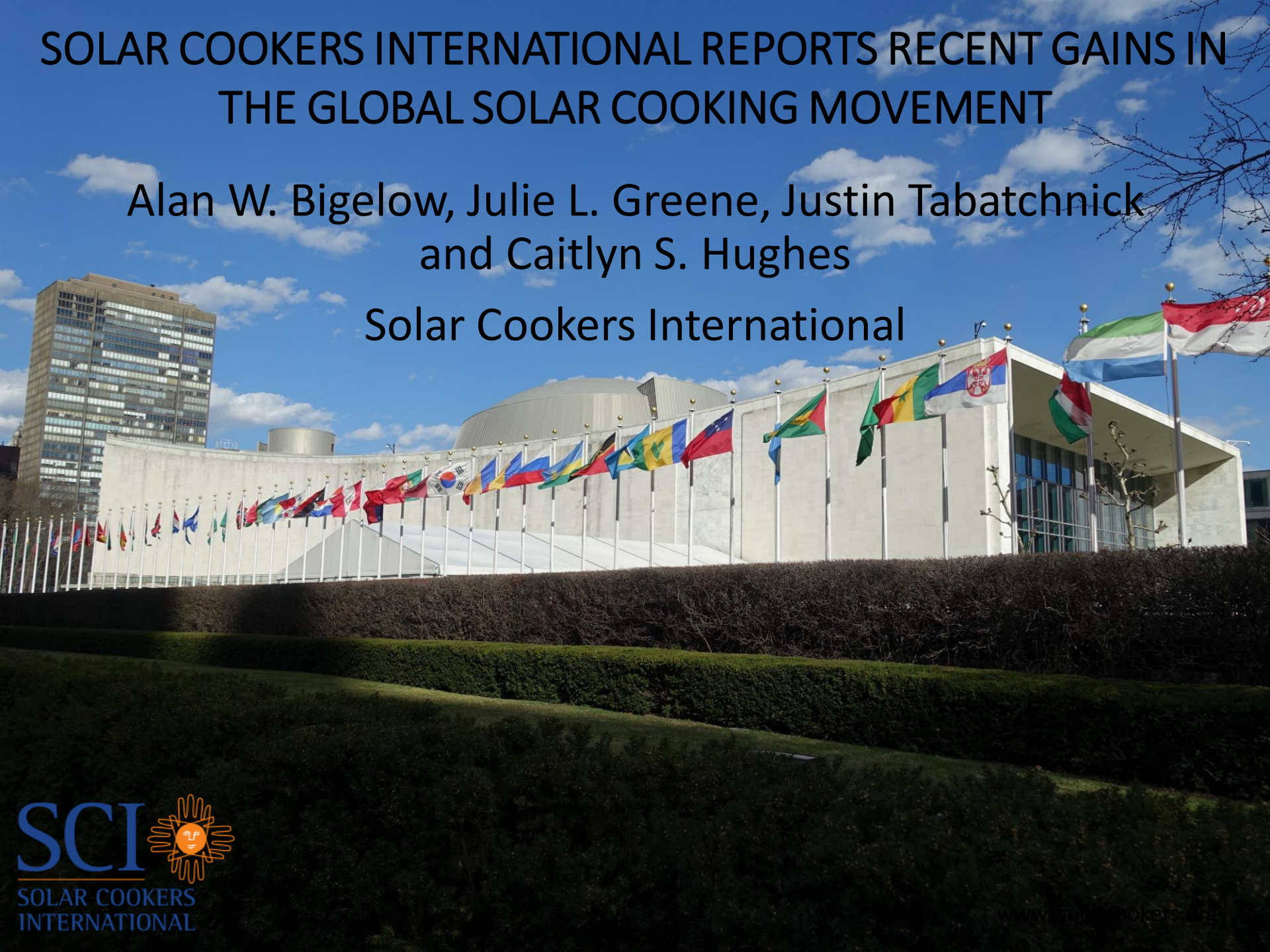
SOLAR COOKERS INTERNATIONAL REPORTS RECENT GAINS IN THE GLOBAL SOLAR COOKING MOVEMENT

Alan W. Bigelow, Julie L. Greene, Justin Tabatchnick and Caitlyn S. Hughes

Solar Cookers International



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Special Consultative Status at ECOSOC

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Solar Cookers International supports the SDGs

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SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY

Access to free, no-emission solar thermal energy builds resilience, particularly for the most vulnerable populations. Energy access for all is key to development; hence, policies encouraging solar technologies will help end poverty.

2 ZERO HUNGER

With free solar thermal energy for cooking, families can cook all traditional and highly nutritious foods. Solar energy access reduces demand for biomass and fossil fuels, and improves land, soil and water quality.

3 GOOD HEALTH AND WELL-BEING

Women and their young children experience the highest exposure to household air pollution, the number one cause of disease. Because solar thermal cookers do not produce flames, fire risk and respiratory illness is greatly reduced.

4 QUALITY EDUCATION

Freed from the time-intensive tasks of gathering biomass fuel for cooking fires by solar cooking, vulnerable persons, including the indigenous, those with disabilities, and children, reclaim time for education and study.

5 GENDER EQUALITY

Using solar cookers reduces exposure of women and girls to violence when gathering biomass fuels. By using free solar energy for cooking, women and girls can gain up to 5 hrs/day for education, empowering them for leadership roles.

6 CLEAN WATER AND SANITATION

Sustainable management of drinking water supplies for all will rely on decentralized pasteurization of local water sources. Solar thermal cookers can make water safe to drink, addressing water scarcity and reducing diarrheal disease.

7 AFFORDABLE AND CLEAN ENERGY

Solar thermal energy is clean, efficient, sustainable, modern energy: it does not need to be gathered or purchased, and is available in all regions on all continents. It requires no supply chain, and no infrastructure for delivery.

8 DECENT WORK AND ECONOMIC GROWTH

By cooking with free solar energy, household cooking fuel costs can be redirected. With less need to gather or purchase fuels, women gain time for education, productive employment and decent work.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Solar technologies reduce the need for energy infrastructure and increase resilience for all by providing decentralized sustainable energy. Many innovative solar cookers can be made using locally-sourced materials.

10 REDUCED INEQUALITIES

Free solar energy is of proportionately higher value to those who benefit most from access to decentralized, free energy. Free solar energy is accessible to all, irrespective of age, sex, disability, ethnicity, origin, religion, or economic status.

11 SUSTAINABLE CITIES AND COMMUNITIES

Solar energy can be used in urban settings where biomass fuels are not available, reducing reliance on unsustainable fossil fuel for cooking and water pasteurization. Solar energy use reduces competition for energy in urban settings.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Free solar-thermal energy has an equitable and decentralized distribution chain, reducing environmental costs of fuel production and delivery. This can contribute to sustainable patterns of energy consumption and production.

13 CLIMATE ACTION

Use of free, no-emission solar energy reduces production of climate-change forcing agents, such as greenhouse gases and black carbon produced by combustion of fossil fuels and biomass fuels.

14 LIFE BELOW WATER

Preserving biomass maximizes water absorption in soil, reducing soil erosion that flows into the marine environment. Ultimately, solar energy reduces deposits of pollutants and fertilizers in the oceans.

15 LIFE ON LAND

Cooking and pasteurizing water with solar energy preserves forests, and curbs land degradation and desertification.

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

Access to solar energy achieves our human right to cooked food and safe water. Solar energy reduces human conflict over scarce fuels.

17 PARTNERSHIPS FOR THE GOALS

Knowledge sharing for appropriate solar cooking technologies strengthens and empowers community members, particularly women, to be change agents for revitalized, sustainable development.

Solar Cookers International (SCI) performance evaluation process (PEP)

- Respond to the needs of the solar cooking sector
- Benefit customers, manufacturers and project leaders
- Harmonize with:
  - ✓ Global Alliance for Clean Cookstoves
  - ✓ ISO/TC 285
- Thermal performance test – more tests under development

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ASAE S580.1 Testing and Reporting Solar Cooker Performance

- Testing time during mid day (solar noon +/- 2 hours)
- Load a solar cooker with water: 7000 g/m^2
- During evaluation, record: water temperature, ambient temperature, wind speed, and solar energy
- Calculate the cooking power for 10-minute intervals
- Cooking power for each interval shall be corrected to a standard insolation of 700 W/m^2 by multiplying the interval observed cooking power by 700 W/m^2 and dividing by the interval average insolation recorded during the corresponding interval.
- Plot cooking power v. temperature difference from ambient
- Provide a single power measure of thermal performance, in Watts

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Aperture of a solar cooker

(inspired by Bernhard S. Müller)

First determine the solar cooker elevation angle
Elevation angle = arcsin (footprint / hypotenuse)

Photograph the solar cooker with a camera parallel to the solar cooker elevation angle

Superimpose geometric shapes and sum areas (areas are scaled according to size of cooker)

Apply a trigonometric correction for the average sun elevation angle for the test date

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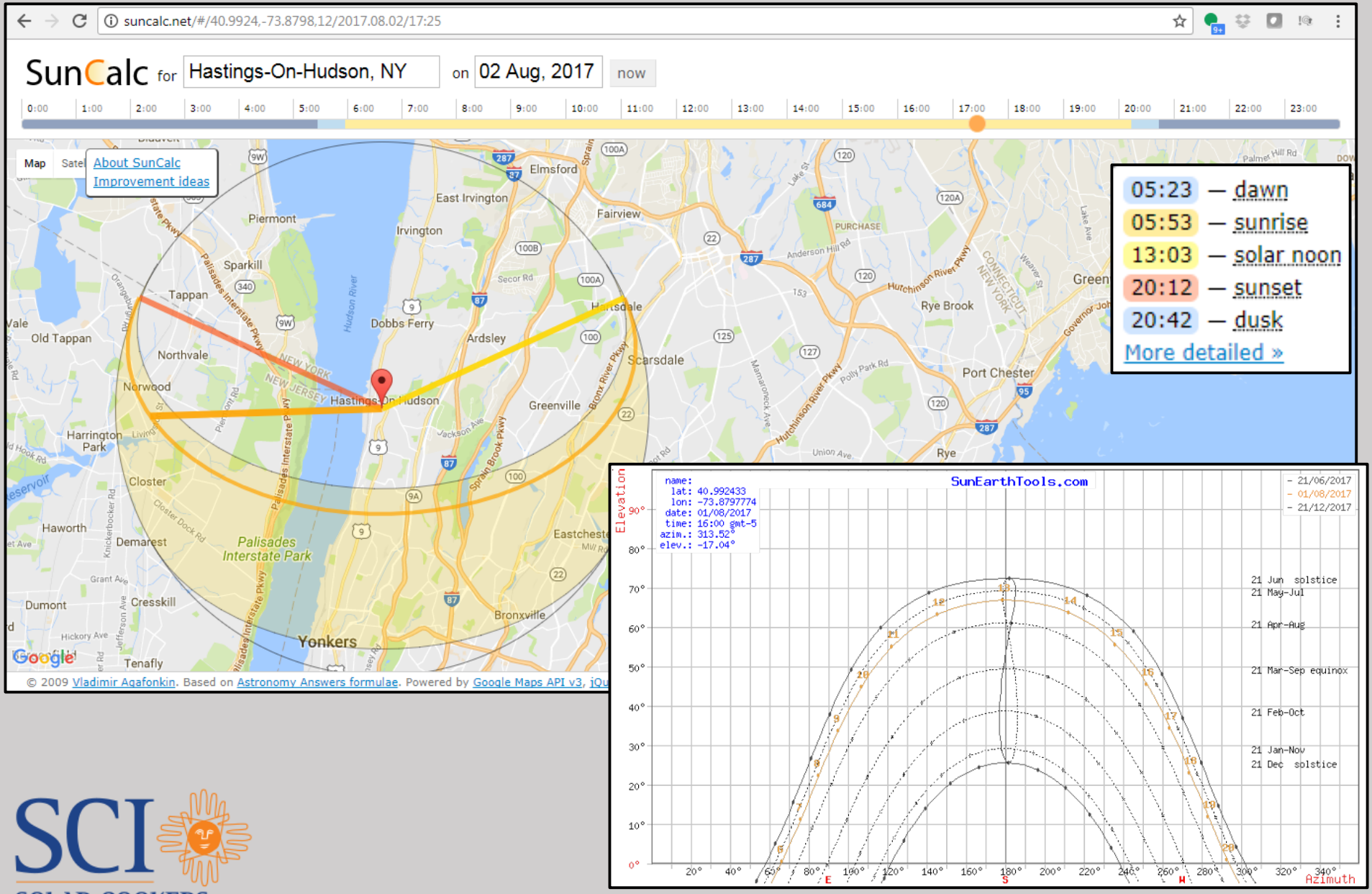
Internet tools for finding **solar noon** and **average sun elevation angle**, anytime, anywhere



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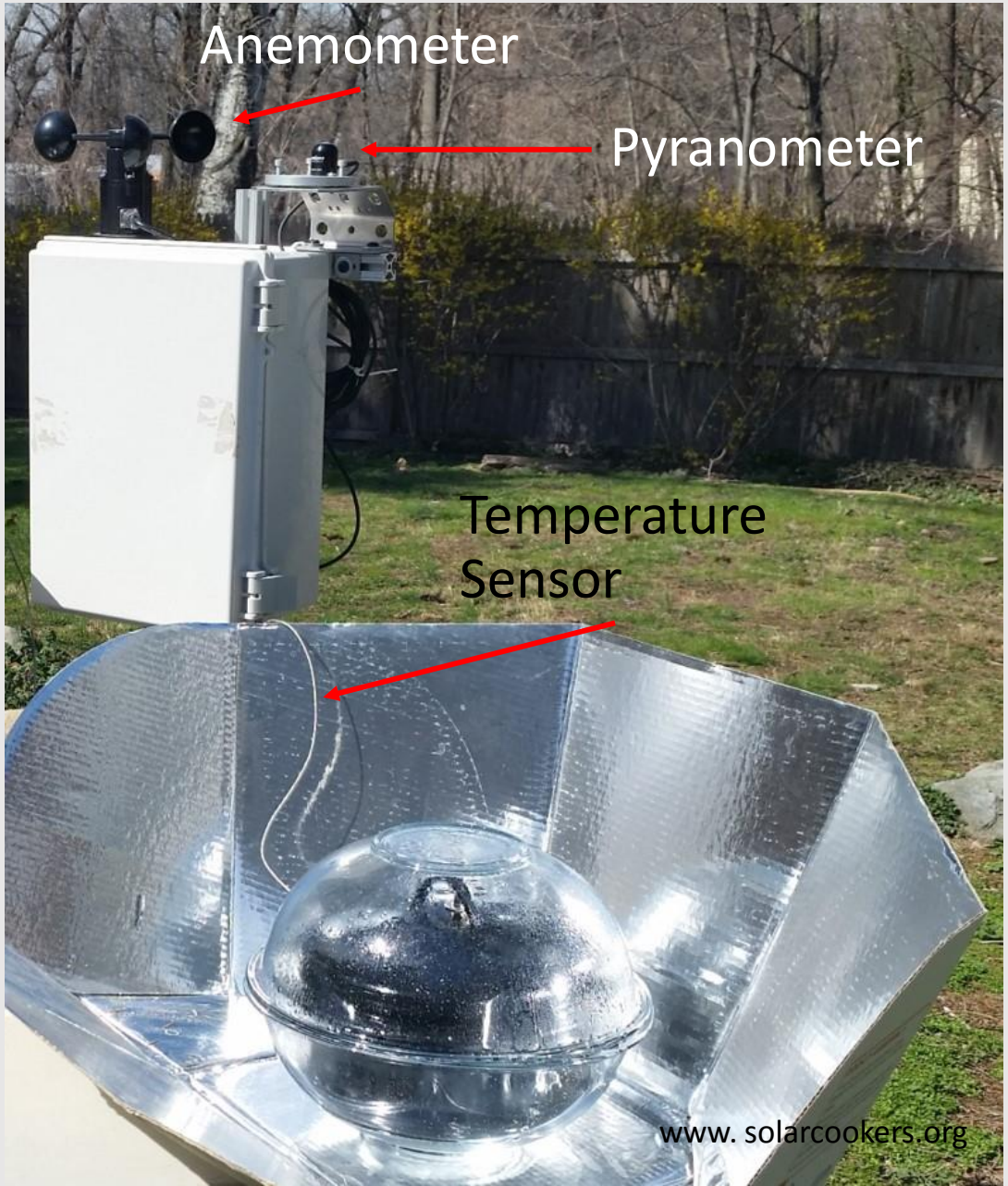
SCI Performance Evaluation Process Testing Station

Designed and assembled by

Justin Tabatchnick

Contractor for
Solar Cookers International



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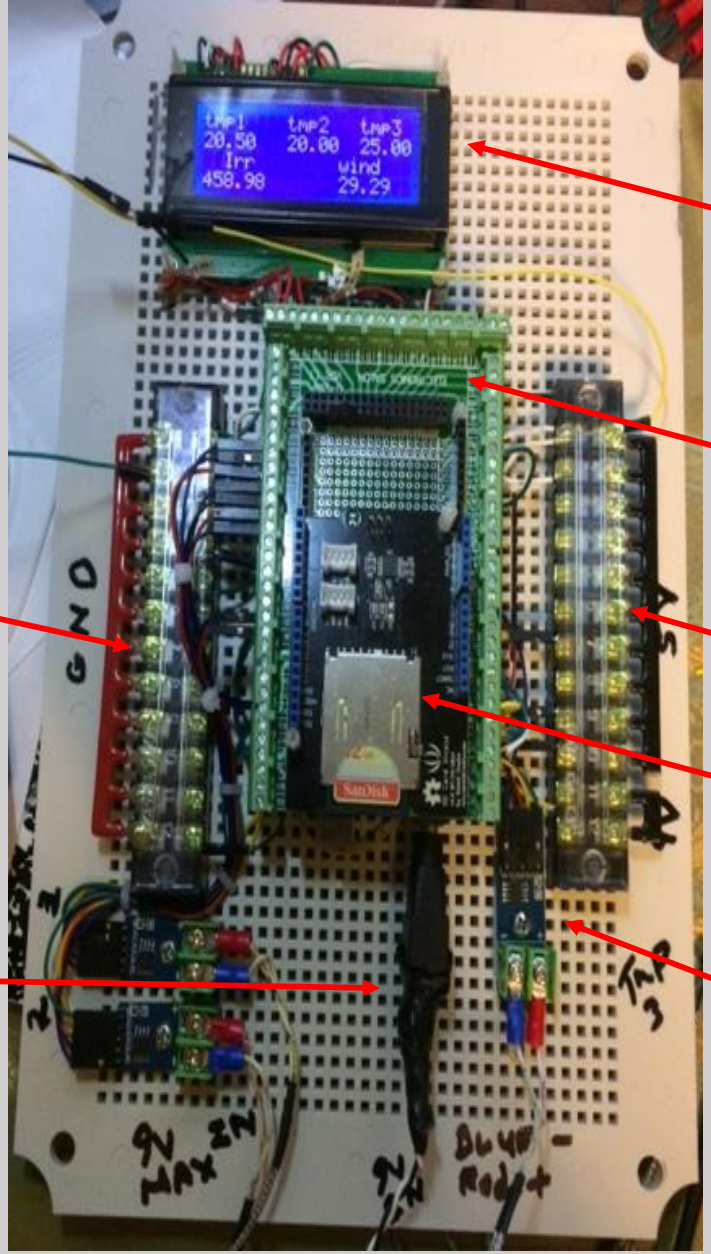
Electronics Layout



Display

External Wiring Module

Ground Bus

Power Bus

SD module

Input Power

Thermocouple

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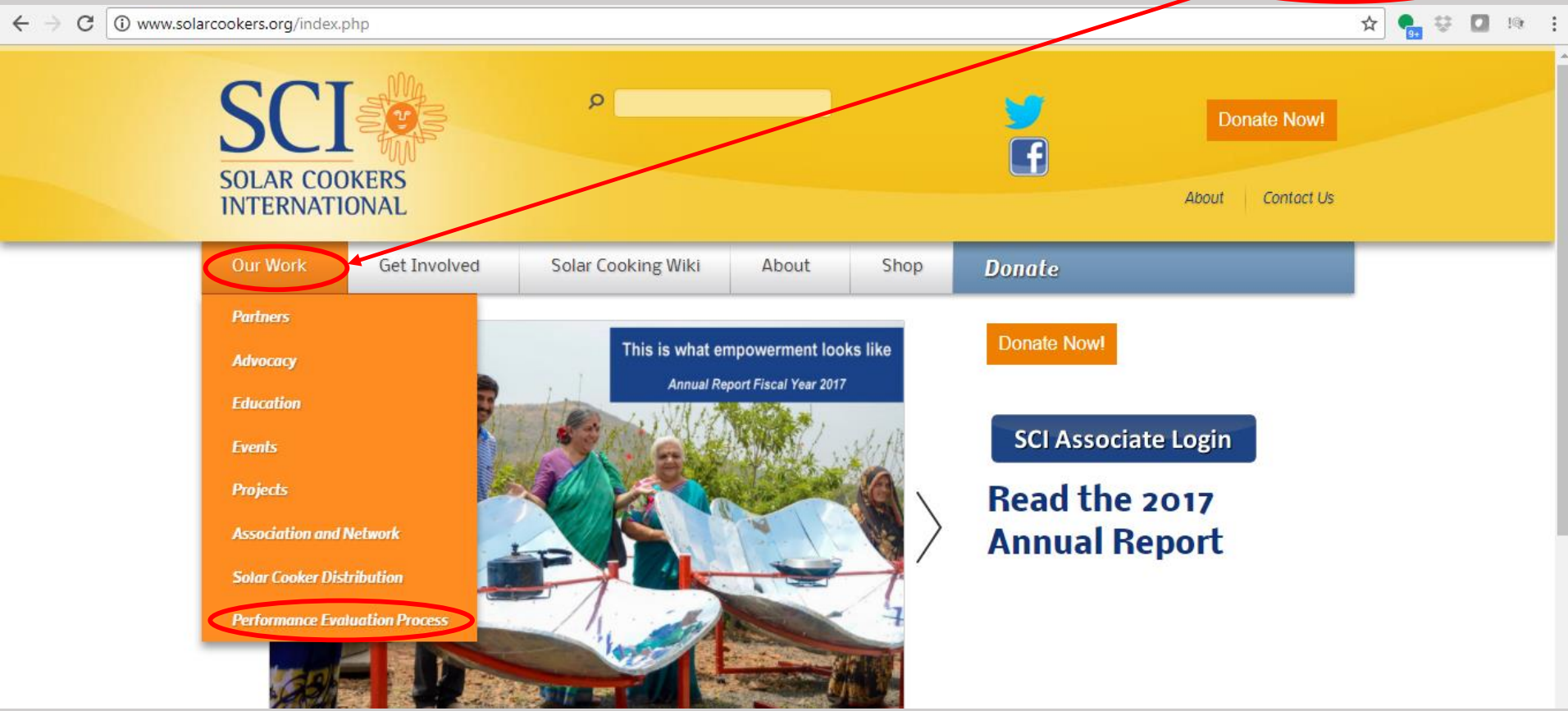
Testing station design:

Portable, Robust, Relatively low cost (parts < $1,000)

Simple to use, Data storage on SD card, and Open source



DataLog Example after import to Excel

time	Temp1	Temp2	Temp3	windspeed	irradiance_meas	irradiance_calc	max_wind	corr_irradiance_mean	corr_irrandiance_stdv	inter_pwr1	inter_pwr2	inter_pwr3	pwr_inter1	pwr_inter2	pwr_inter3	Td1	Td2	Td3	inter_num
95	17.64	21.72	16.87	0.59	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
2074	17.41	21.27	17.32	0.3	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
3806	16.5	21.95	16.87	0.3	966.8	1018.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
5540	17.64	22.87	17.09	0.89	966.8	1018.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
7276	6.19	29.04	17.09	0.79	966.8	1018.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
9008	22.91	8.69	17.55	0.98	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
10741	98.05	-3.43	17.32	0.98	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
12473	85.45	-3.43	17.32	0.79	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
14207	94.39	-3.43	16.87	0.59	965.58	1017.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
15941	94.39	-3.43	17.32	0.5	966.8	1018.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
17676	64	8.3	18.9	0.4	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
19410	56.5	5.9	18.8	0.3	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
21144	72	8.2	18.9	0.01	966.8	1018.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
22877	70.6	8.2	18.8	0.11	970.46	1022.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
24611	75.2	2.4	18.9	0.3	970.46	1022.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
26345	71.5	5.6	18.9	0.59	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
28078	68.9	7.4	18.9	1.08	971.68	1023.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
29815	59.7	10.4	18.9	1.38	971.68	1023.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
31550	64	7.9	18.9	1.77	971.68	1023.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
33283	53.4	12.9	19	1.57	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
35017	44.8	10.4	19	1.18	965.58	1017.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1

109589	53	4.3	19.3	0.11	968.02	1019.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
111322	53.2	4.3	19.4	0.01	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
113056	53.2	7	19.4	0.2	965.58	1017.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
114792	56	4.4	19.4	0.2	966.8	1018.31	NA	NA	NA	NA	NA								1
116524	56.1	9.4	19.5	0.2	970.46	1022.17	NA	NA	NA	NA	NA								1
118258	58.5	9	19.3	0.11	966.8	1018.31	NA	NA	NA	NA	NA								1
119990	46.8	13.1	19.4	0.11	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
121725	41.4	15.6	19.4	0.2	971.68	1023.45	1.77	1005.68	14.19	1657.62	0	176.82	1153.78	0	123.07	52.35	0	12.1	1
123466	36	13.1	19.4	0.3	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
125203	50.5	12.6	19.5	0.3	969.24	1020.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
126937	58	15.1	19.5	0.3	971.68	1023.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
128671	50.7	15	19.6	0.3	972.9	1024.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
130405	50.7	15.1	19.6	0.79	972.9	1024.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
132140	46.3	17.7	19.6	0.79	971.68	1023.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
133875	41.3	16.1	19.6	0.69	972.9	1024.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
135612	42.2	13.3	19.6	0.5	970.46	1022.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
137346	50	10.7	19.7	0.5	971.68	1023.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2

End of Interval 1 and start of interval 2

Interval Calculations completed

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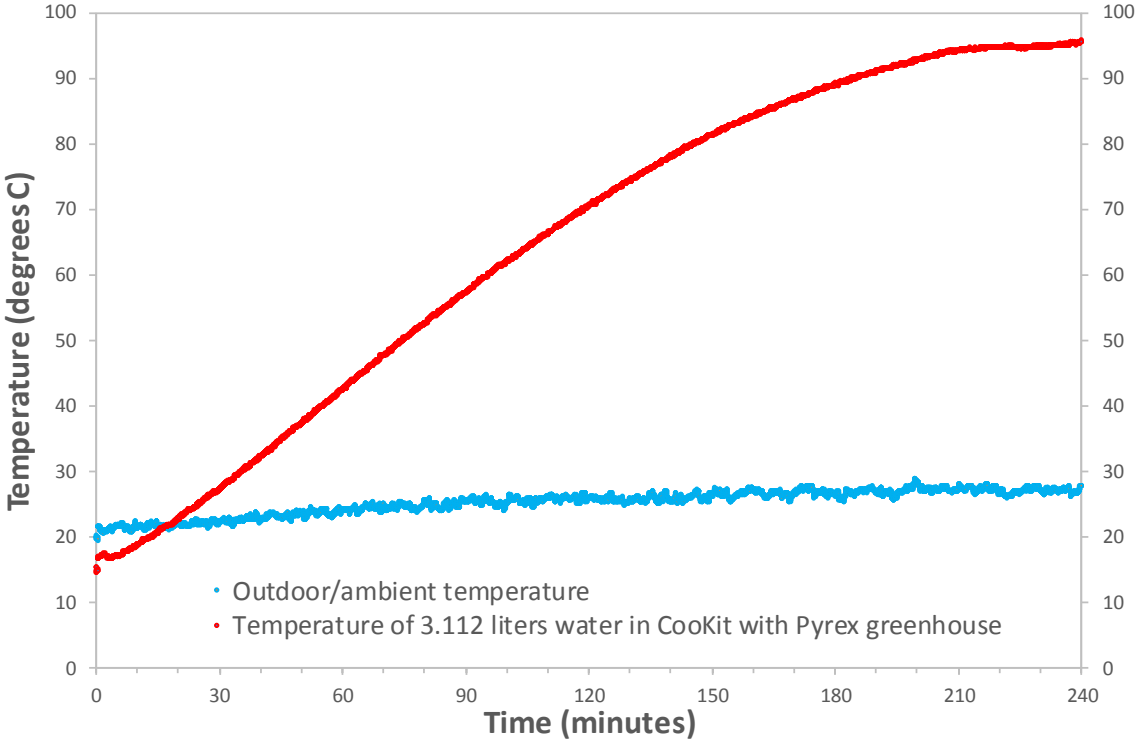

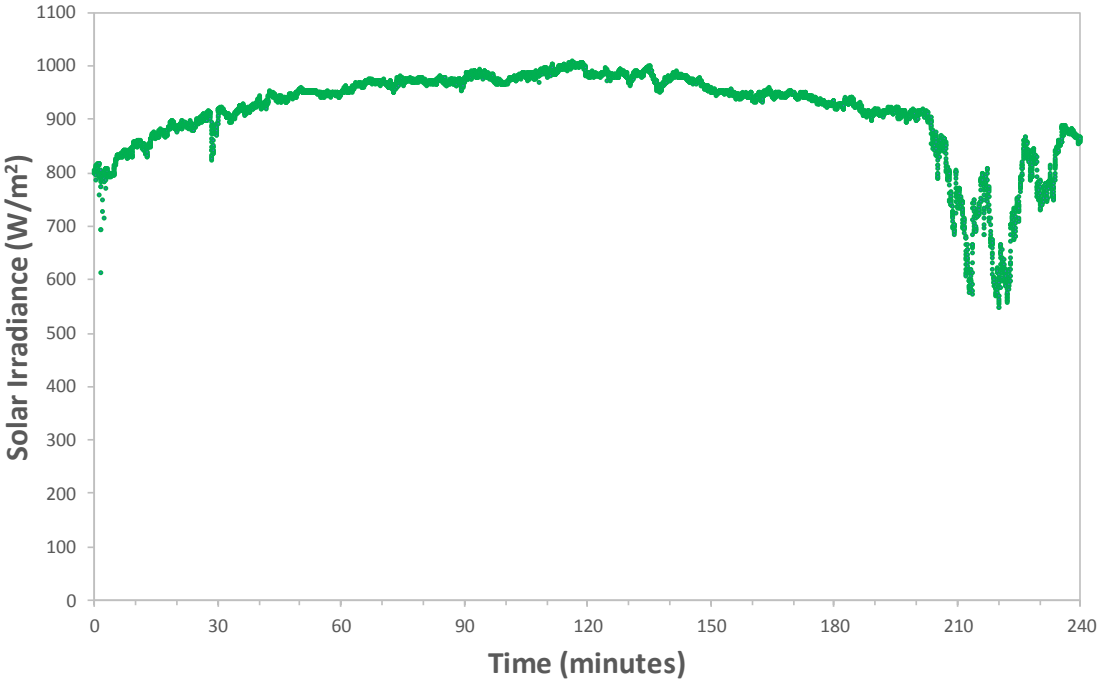

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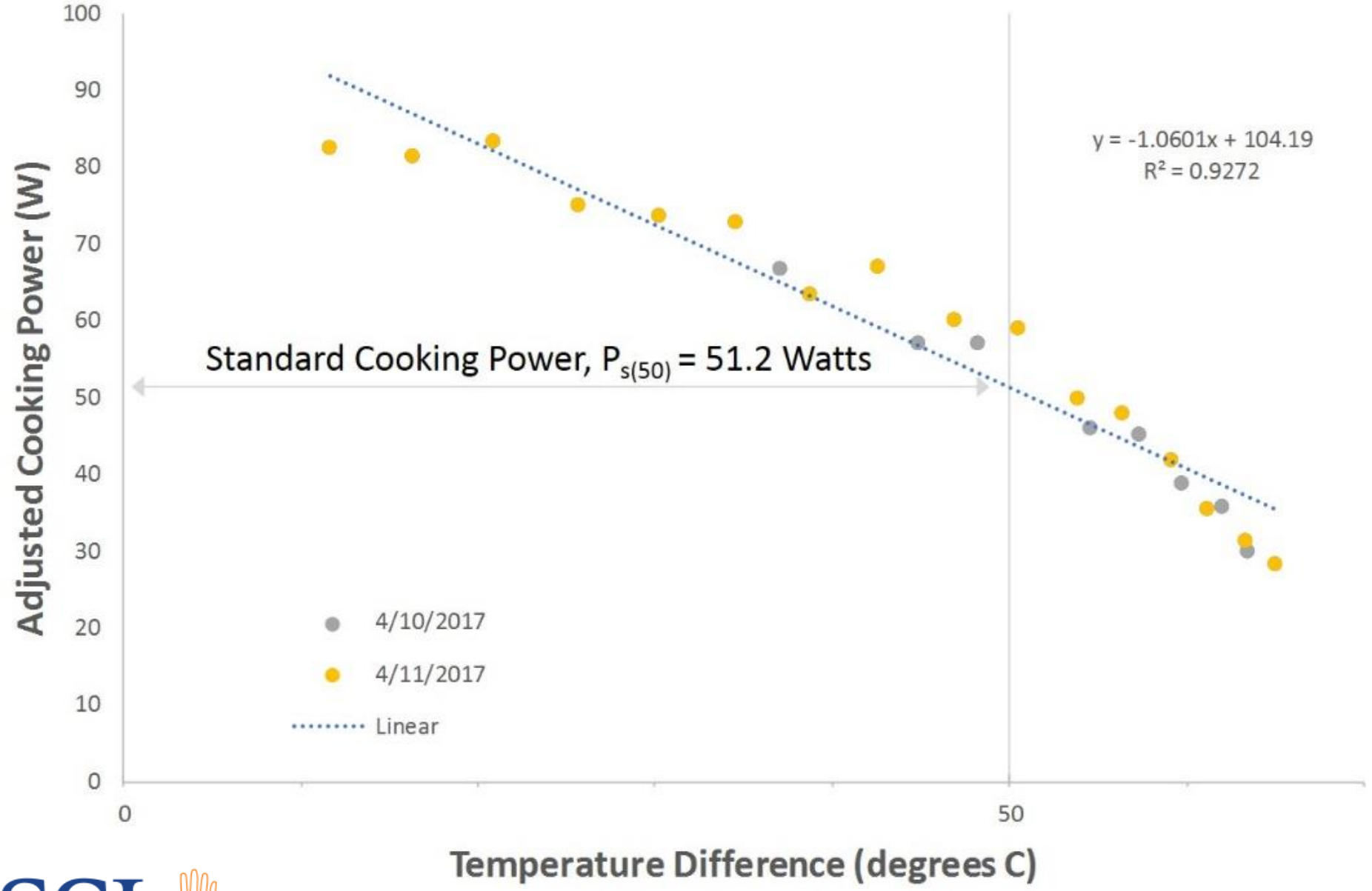

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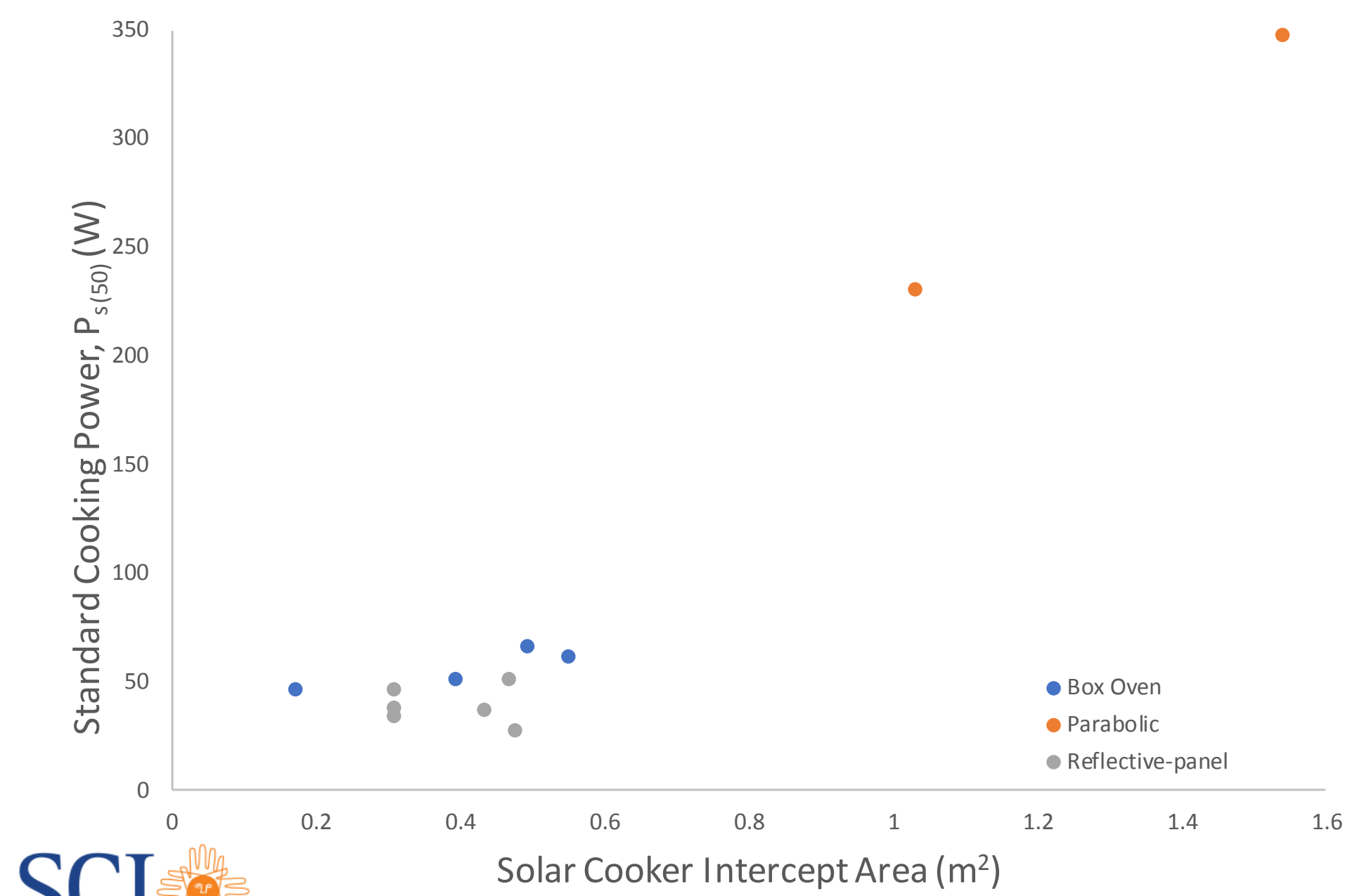

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Observations:

- Preliminary SCI PEP results suggest average Standard Cooking Powers, $P_{s(50)}$ (W), per solar cooker type:
  - ✓ Box Oven: 56 W
  - ✓ Parabolic: 289 W
  - ✓ Reflective-panel: 39 W
- Applying these values to SCI's known global solar cooker distribution by type suggests a global installed solar-thermal cooking capacity of at least **377 MW**

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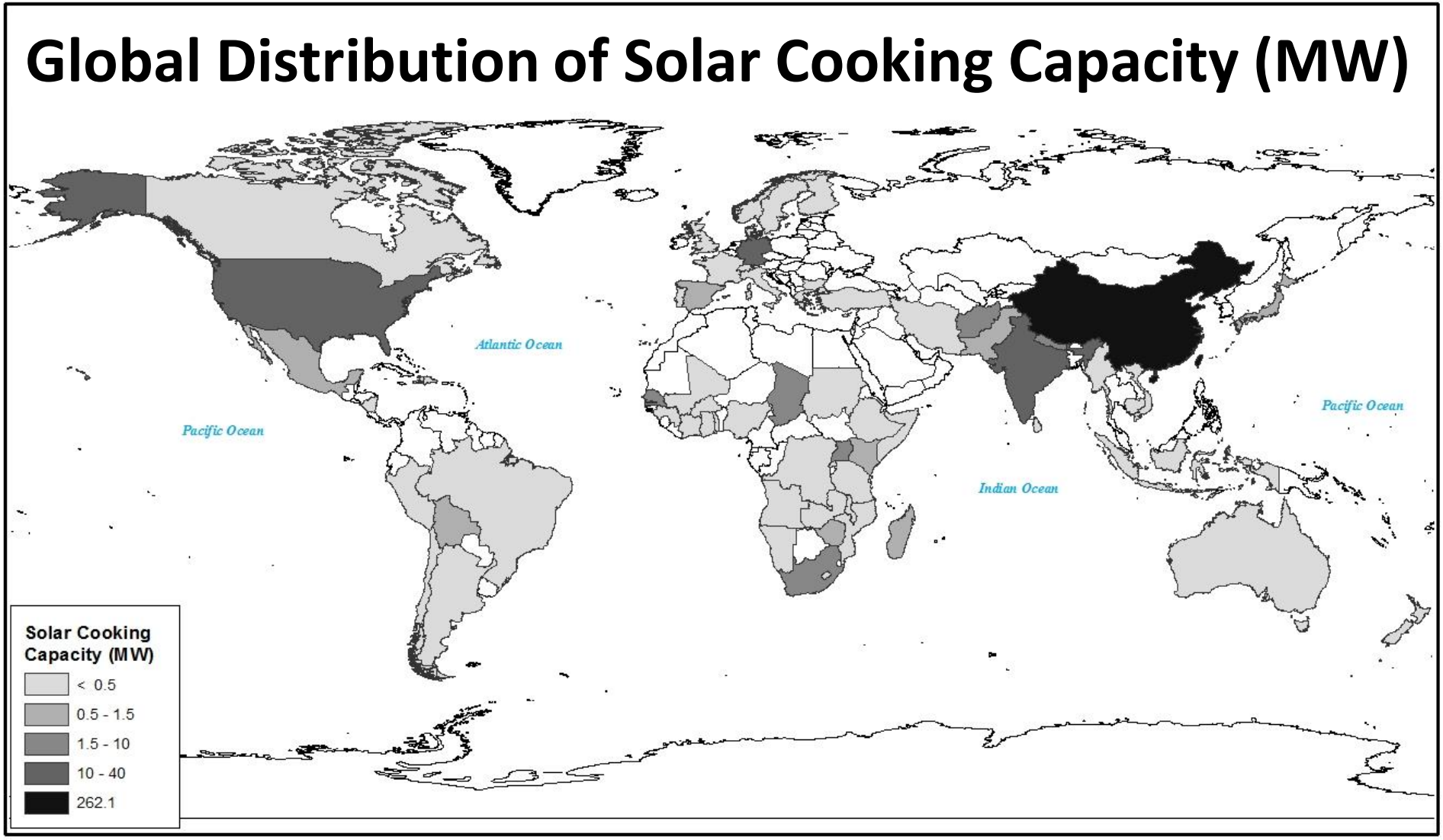
Global Distribution of Solar Cooking Capacity (MW)



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Global distribution of solar cooking capacity (MW), based on preliminary data and total known solar cooker distribution, as of summer 2017.

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Suggestions for Sector:

- Manufacturers: please provide information about intercept area, elevation angle, and suggested cookware
- Solar-cooking sector: please continue to post distribution data to SCI
- Consult (preliminary) results: www.solarcookers.org/PEP

Next Steps:

- Promote: Network of SCI Testing Centers
- Construct test stations for additional testing centers
- Develop additional testing protocol: durability, usability, etc.

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Solar Cooking at the American Solar Energy Society Conference

- Denver, Colorado, USA
- October, 2017

- 4100 digital solar cooking engagements
- 400 in person participants
- 11 solar cooking presentations

SCI Board Member Wyldon Fishman (left) and SCI Science Director Alan Bigelow, Ph.D. (center) demonstrating solar cookers at the ASES conference.

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Solar Cooking at the Clean Cooking Forum

SCI Global Advisor Deepak Gadhia

- 500+ people exposed to solar cooking
- 30 solar cooking session participants
- 8 solar cooking advocates
- 3 poster presentations
- 1 site visit to the Community Solar Steam Cooking System at a Brahma Kumaris Retreat Center

SCI Global Advisor Dr Mrs Janak Palta McGilligan & SCI Science Director Alan Bigelow, Ph.D.

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SCI at ISO/TC 285 Meeting

Participants following a discussion about field testing, including SCI Associate Godfrey Kaburu and SCI Science Director Alan Bigelow, Ph.D.

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Site Visit to Machhegaun

SCI Associate Godfrey Kaburu; Allart Ligtenberg; Jacek Kopycinski; SCI Associate Sanu Kaji Shrestha; SCI Science Director Alan Bigelow, Ph.D.; SCI Associate Kriti Shrestha and solar cooking women of Machhegaun, Nepal.

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PEP at CRT/Nepal Testing Center

SCI Science Director Alan Bigelow, Ph.D. and Prabin Shrestha.

Ryan Tompson; Santosh Mandal; Chija Adhikari; Ganesh Shrestha; SCI Science Director Alan Bigelow, Ph.D. at the Centre for Rural Technology (CRT) Nepal.

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Solar Cooking at COP23

- 20,000 people exposed to solar cooking
- 10+ government ministerial representatives excited about solar cooking
- 4 press conferences
- 4 presentations/side events
- 2 new SCI Associates
- 1 exhibit booth

SCI Program Director Caitlyn Hughes; SCI Associate Honorable Commissioner Nigeria Ministry of Climate Change and Forestry Dr. Alice Ekwu; SCI Executive Director Julie Greene

SCI COP 23 Side Event: SCI Science Director Alan Bigelow, Ph.D., Head of Project India One Golo Pilz; Rocio Maldonado; SCI Program Director Caitlyn Hughes

SCI COP 23 Press Conference: SCI Board Member Mike Paparian; SCI Program Director Caitlyn Hughes; SCI Science Director Alan Bigelow, Ph.D.; The Nature Conservancy CA Climate Change Program Director Louis Blumberg; Global Solar Council CEO Jodie Roussell

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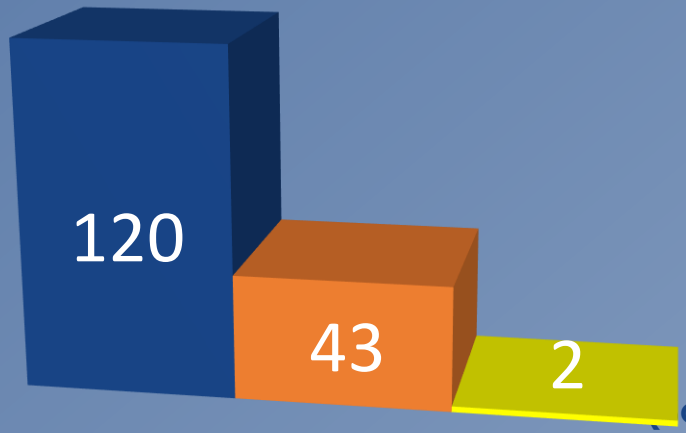
Nationally Determined Contributions (NDCs)



No mention of cooking

Mention cooking/cookstoves

Mention solar cooking

**165 submitted as of 31 Dec 2017*

Of 165 NCDs summitted, 43 mention cooking or cookstoves

2 additional NDCs have specifically included solar cooking as a sustainable approach

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Data Sharing

Call to action for data collection:

- Use the SCI Adoption and Impact survey
- Update solar cooker distribution data annually on SCI's interactive data map

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Reported sites for distribution and/or use of solar cookers in Haiti, as of May 10, 2017

(by Solar Cookers International: www.solarcookers.org)

- Anse-à-Pitres
- Aquin
- Arniquet
- Bainet
- Barreau
- Bereaud
- Camp-Perrin
- Carrefour
- Chantal
- Cité Soleil
- Coteaux
- Côtes-de-Fer
- Croix-des-Bouquets
- Delmas
- Dos Palais
- Duverge
- Fond-des-Blancs
- Fonds Des Negres
- Fond-Verrettes
- Furcy
- Gonave Island
- Gris-Gris
- Guichard
- Hinche
- Ile a Vache
- Jacmel
- La Colline
- Lambert
- Layaye
- Léogâne
- Les Cayes
- Mariani
- Miragoane
- Mizak
- Petion-Ville
- Petit Goave
- Petite Rivière de l'Artibonite
- Pignon
- Port-au-Prince
- Port-de-Paix
- Potino
- Roche-a-Bateau
- Saint Michel
- Saint Michel Du Sud
- Tamarin
- Tilori
- Virgile des Nippes

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Haiti's Newest Solar Chefs

Talk about inspiring! This month Haiti Adolescent Girls Network (HAGN) has launched their solar-cooking micro-enterprise program for sixteen aspiring teen girls. In this program each participant will receive a Solavore Sport solar oven, cooking (and solar cooking) training, and basic business skills training. They'll be cooking food and baked goods to sell at market as their first step in becoming independent businesswomen. Imagine the impact on their gross margin by not having to purchase charcoal at Haiti's escalating prices.

HAGN solar-cooking entrepreneurs unveiling their new Solavore Sport solar ovens under the watchful guidance of Solavore advisor Rose Bazile (second row in red).

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Three specific ways you can engage in global advocacy and increase partnerships to amplify your work.

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1. Join SCI's strategy teams to advocate for solar cooking at global conferences (ex: UNFCCC COP, SAFE, Clean Cooking Forums, High-Level Political Forums, etc.)

High Level Political Forum 2017

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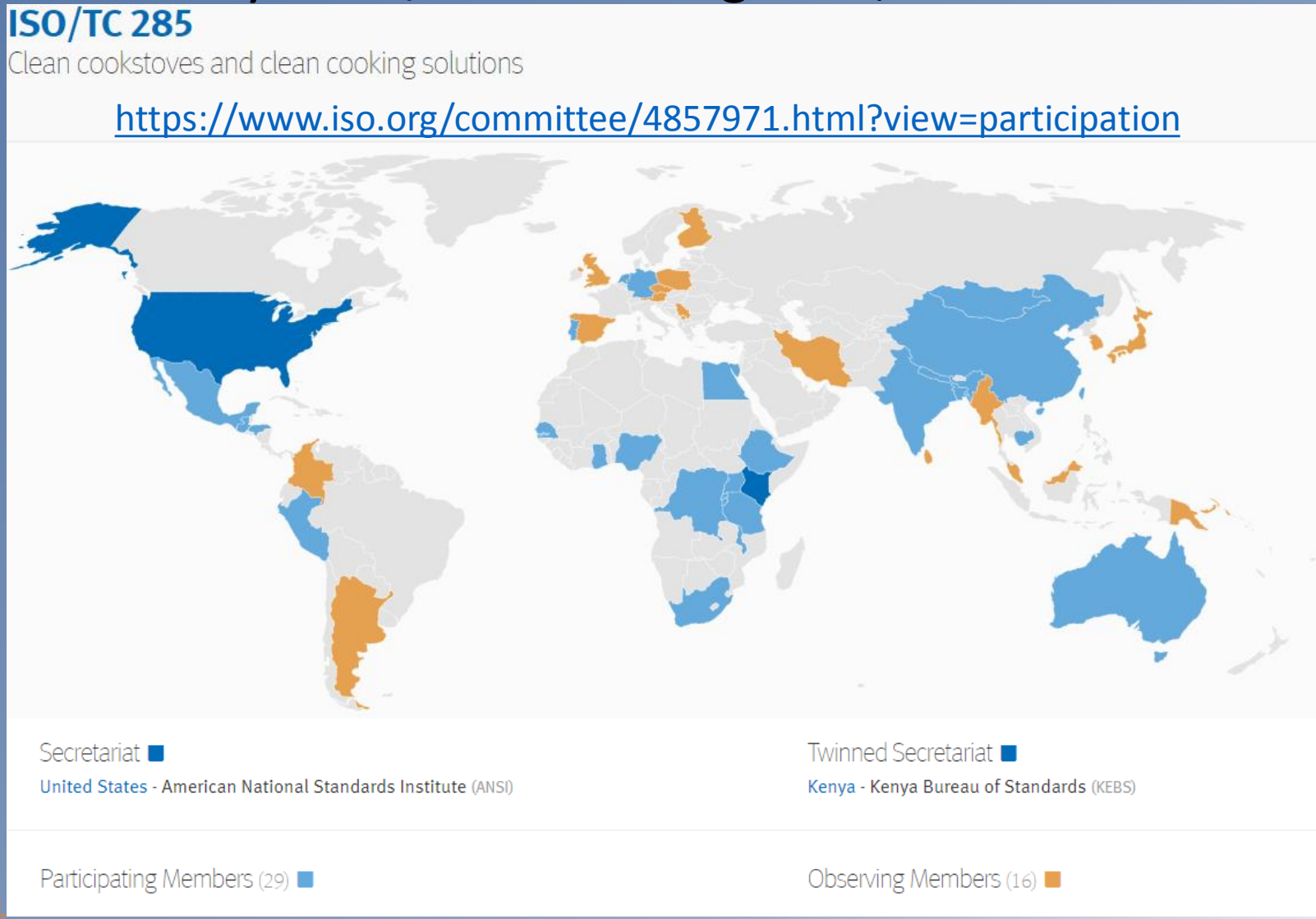
2. Join your country's ISO/TC 285 delegation, if it is involved.



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3. Be an active partner in the SCI Association.

Join an elite group of academics, decision makers, designers, manufacturers, entrepreneurs, innovators, advocates, humanitarians, environmentalists, and NGOs working to promote solar thermal cooking worldwide.

http://www.solarcookers.org/our-work/sciassociation/association-benefits/associates-directory/

South Asia	Jaxina Constructions Pvt. Ltd.	Rajinder Singh Korotana
	Jaxina Constructions Pvt. Ltd.	Gursimran Singh
	Jimmy McGilligan Centre For Sustainable Development	Dr Mrs Janak Palta McGilligan
	PRINCE (Promoters, Researchers, & Innovators in New & Clean Energy)	Prof. Ajay Chandak
	Muni Seva Ashram	Mr. Deepak Gadhia
	Synergy Engineering and Environmental Solutions	Bidhan Chandra Loitongbam
	TinyTech Plants	Kedar Mehta
	Vedant Solar Power	Kumar S Pawar
Europe (Western, Northern, Southern, Eastern)	ACCESO	René Bijloo
	Applied Green Technology	Mr. Roger Whitten
	EG-Solar	Dr. Dieter Seifert
	Heliac Silver Level	Ms.Sedi Louis Byskov
	Heliac Silver Level	Mr. Gideon Carnigal
	Heliac Silver Level	Cristina Crespo Montañés
	Heliac Silver Level	Mr. Karsten Dupont
	Heliac Silver Level	Mr. Jakob Jensen
	Heliac Silver Level	Ms. Maria Matschuk
	Heliac Silver Level	Mr. Henrik Pranov
	International Solar Energy Society Bronze Level	Joanna Costello
	International Solar Energy Society Bronze Level	Public Relations
	Kent Sudanese Society	Mr Khalid Abdalla
	Lernen Helfen Leben (LHL)	Bernhard Mueller
	Lightoven	Dr. Hartmut Ehmler

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Individual Associate benefits

EVENTS

- Travel funding priority consideration
- Reduced fees

KNOWLEDGE

- Webinars
- Article database
- *SCI Digest*

NETWORKING

- SCI Associate Directory

PUBLICITY

- *SCI Digest*
  - Feature article
  - Ad discounts
- Solar Cooking Wiki page support

RECOGNITION

- Certificate, card, website logo
- SCI website, Wiki, Annual Report, *SCI Digest*

Organization Associate benefits

(For NGOs, businesses, academic departments, government agencies and groups)

Levels	Bronze	Silver	Gold
# Individual Associates' benefits	3	7	10

Recognition	Networking	Events	Knowledge	Publicity
Sharing your posts with SCI's **27,000+** Facebook followers* **Retweeting** your organization's Twitter tweets **for** SCI's **1000+** followers* **Organization profile** in SCI *Digest* twice a year*	**Quarterly town hall meeting** (conference call) **Individual Associates b**enefits	**Discounted sponsorship rates**	Webinar certificate of participation	**Acknowledgement** a s an Organizational Associate at SCI conferences and events **Free posting** for **employment opportunities** in *SCI Digest*

*based on level

SOLAR COOKERS INTERNATIONAL

www. solarcookers.org

People you'll meet…

Julie Greene,
Executive Director

Caitlyn Hughes,
Program Director

Loretta Pehanich,
Development Director

Levi McGarry,
Program Associate

Jordyn Pruitt,
Development Associate

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People you'll meet…

Tom Sponheim
SCInet wiki Webmaster
(part-time)

Paul Hendrick
SCInet wiki Webmaster
(part-time)

Ben Hendrick
SCInet wiki Webmaster
(part-time)

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30th Anniversary

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1987 - 2017

Thank you!

Alan W. Bigelow, Julie L. Greene, Justin Tabatchnick and Caitlyn S. Hughes

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