SCI
SOLAR COOKERS INTERNATIONAL

Solar Cooking Economic Impact Summaries
Sources and Calculations

SCI relied on many sources and data to compile the Solar Cooking Economic Impact summaries. Estimates and extrapolations have been used when necessary due to incomplete data. The purpose of the summaries is to highlight the potential economic impacts solar cooking can have around the globe by people switching from cooking with solid fuels to solar cooking. Savings are derived from both environmental and health costs avoided through solar cooking.

SCI requests that any users of this information cite SCI and other sources as appropriate.

- **Number of known solar cookers**: Solar Cookers International Distribution of Solar Cookers Map https://www.solarcookers.org/work/capacity/distribution-solar-cookers

- **% of the population with reliance on solid fuels**: World Health Organization http://apps.who.int/gho/data/node.main.135?lang=en

- **Number of people in the country with reliance on solid fuels**: World Health Organization http://apps.who.int/gho/data/node.main.135?lang=en

- **CO_2 emissions prevented from using existing solar cookers:** Calculations were derived from the California Air Resources Board data at: https://www.arb.ca.gov/cc/inventory/doc/docs1/1a2m_notspecified_industrial_fuelcombustion_wood(wet)_co2b_2015.htm

  SCI uses 1.44 metric tonnes of CO_2 prevented per metric tonne of wood as a multiplier. In addition, based on survey data from solar cooks and collaborators, including Friends of the Old (FOTO), SCI estimates that one solar cooker saves one tonne of wood per year. The CO_2 prevention figures are based on the estimated lifetime of the solar cookers (which vary based on the type of solar cooker).

- **Potentially prevented CO_2 emissions by switching from solid fuels to solar cooking**: These figures are reached by dividing the population number with reliance on solid fuels by the average household size of 3.59 individuals, and then multiplying that figure by 1.44 metric tons of CO_2. Figures are per year. The average household size is a conservative estimate based on the population size in countries with identified solar cookers.

- **2017 GDP**: The World Bank https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?view=chart

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- **Premature deaths due to household air pollution (Burden of disease):** World Health Organization http://apps.who.int/gho/data/node.main.BODHOUSEHOLDAIRDTHS?lang=en

- **Potential savings if 100% of people using solid fuels switched to solar cooking ¼ of the time**: Calculations were made based on two sources:

1. Welfare costs (health): http://documents.worldbank.org/curated/en/781521473177013155/pdf/108141-REVISED-Cost-of-PollutionWebCORRECTEDfile.pdf

2. Environmental costs (social cost of carbon): https://19january2017snapshot.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf

Figures were reached by adding the health savings (welfare costs) and the value of prevented CO_2 emissions (the social cost of carbon) and dividing that total by 4 anticipating that people will solar cook ¼ of the time. This assumes 100% of the population relying on solid fuels switching to solar cooking. These savings are per year.

The United States Environmental Protection Agency (USEPA) calculates the social cost of carbon. SCI used this to calculate the environmental savings of switching to solar cooking. The social cost of carbon is a measure, in dollars, of the long-term damage done by a ton of carbon dioxide emissions in a given year. This figure also represents the value of damages avoided by CO_2 emission reductions. The social cost of carbon includes changes in net agricultural productivity and property damages from increased flood risk for example.

SCI used USEPA's social cost of carbon figure of $42.00 USD, per tonne of CO_2 prevented, and multiplied it by the potentially prevented CO_2 emission figures to reach the environmental savings by country.

The welfare costs of household air pollution were determined by obtaining the number of premature deaths per country due to household air pollution from the World Health Organization Global Health Observatory Data Repository.

In order to apply a dollar amount to each of these lives lost prematurely, the methodology described in the World Bank and Institute for Health Metrics and Evaluation's report, *The Cost of Air Pollution: Strengthening the Economic Case for Action* at http://documents.worldbank.org/curated/en/781521473177013155/pdf/108141-REVISED-Cost-of-PollutionWebCORRECTEDfile.pdf, was used to determine the Value of a Statistical Life (VSL) for each country. Oftentimes VSL is determined through willingness-to-pay (WTP) studies, which assess the amount that members of the population are willing to spend to avoid premature death. However, WTP studies are lacking for many countries, so oftentimes a base VSL from a previous study is adjusted to suit the context of other countries. These adjustments account for characteristics that are likely to influence how individuals under different circumstances value mortality risks. Numerous studies document that the WTP for mortality risk reductions increases for people with higher incomes. The effect of income on VSL is known as income elasticity and is widely quantified for numerous countries through various studies. Income elasticity values for different countries were taken from the World Bank and IHME's report for the calculation of VSL. The study assumed a central income elasticity value of 1.2 for low- and middle-income countries and a value of 0.8 for high-income countries.

To calculate country-specific VSL values, a base VSL of $3.83 million was used, which represents the mean VSL estimate from a database of quality-screened WTP studies conducted in high-income member countries of the Organisation for Economic Co-operation and Development (OECD), used in the World Bank and IHME study. This base VSL was then modified to suit each country by accounting for the ratio of the GDP per capita for the country to the GDP per capita for the base sample of OECD countries during the same year, and adjusting this number based on income elasticity. The VSL was then multiplied by the number of premature deaths from household air pollution for each country to determine the total welfare costs from household air pollution per country during a certain year.

In summary, SCI relied on the World Bank and Institute for Health Metrics and Evaluation's report that used the average amount that someone was willing to pay to avoid dying early from household air pollution in high-income countries and adjusted this amount for different countries based on that country's average GDP per person and income levels, then multiplied this value by the estimated number of total deaths per year per country from household air pollution. This is the total amount of money lost from premature deaths from household air pollution per country. These figures were used as the potential health savings, which when added to the environmental savings, can be used to estimate total potential savings.