

**POWER<sub>FOR</sub>ALL**



## **The Energy Access Dividend Compendium**

**Key Facts on Energy Access and the SDGs**

# Contents

3	<b>Lifting People Out of Poverty</b>	SDG 1 / SDG 8
5	<b>Boosting Agriculture and Improving Nutrition</b>	SDG 2
7	<b>Keeping Families and Communities Healthy</b>	SDG 3
10	<b>Education</b>	SDG 4
12	<b>Improving Children’s Welfare</b>	SDG 4 / SDG 5
14	<b>Empowering Women as Sustainable Energy Leaders</b>	SDG 5
16	<b>Improve Safety for Vulnerable Communities</b>	SDG 5
18	<b>Supporting Sanitation and Access to Clean Water</b>	SDG 6
20	<b>Making Energy Access Affordable</b>	SDG 7
22	<b>Jobs and Decentralized Renewable Energy</b>	SDG 8
24	<b>Supporting Climate Resilience and Adaptation</b>	SDG 9 / SDG 11 / SDG 13
26	<b>Powering a Climate Friendly Future</b>	SDG 13
28	<b>Black Carbon and Energy Access</b>	SDG 13



*Sustainable Development Goals (SDGs)*

---

## About this Report

### Uncovering the facts on how decentralized energy access helps power the SDGs

One of the biggest gaps identified by the decentralized renewable energy (DRE) sector is access to quality information and data-driven models for decision making. Governments considering electricity access interventions lack a standardized model to weigh the trade-offs and timeliness of various electrification options and may, unintentionally, make choices that actually reduce the net benefits of electricity to the energy poor.

Decision makers lack a framework through which to assess the foregone or delayed social, development benefits or dividends of turnkey energy access via DRE. In our 2016 point of view, *Decentralized Renewables: The Fast Track to Energy Access, Power for All* expands on this concept of the Energy Access Dividend (EAD), which we define as the opportunity cost of over-dependence on slow, traditional, centralized approaches to electrification while overlooking the ability of DRE to radically accelerate the access timeline.

Understanding the costs of delayed energy access must be rooted in a thorough understanding of energy access's critical relationship to the unlocking of so many other, broader benefits - or sustainable development goals (SDG) - such as poverty reduction, food security, sustainable agriculture, equitable quality education, gender empowerment, productive employment and climate change preparedness. Power for All's Platform for Energy Access Knowledge (PEAK) is a critical tool for easily exploring and connecting such critical evidences. Through exploring the best available literature PEAK's researchers have prepared a series of short, sharp, synthesized fact sheets that help users clearly understand these relationships.

Our Energy Access Dividend compendium, powered by PEAK, draws out the clearest data points by articulating the direct relationship between decentralized energy access and some of the most critical SDGs. This is a living compendium -- as new data becomes available we will update factsheets accordingly.

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Lifting People Out Of Poverty

---

---

# POWER FOR ALL

---

## \$40 billion

IN ANNUAL ENERGY SAVINGS IF ALL HOUSEHOLDS USING KEROSENE AND CANDLES FOR LIGHTING SWITCHED TO SOLAR LIGHTS

## 1.6 million

PEOPLE'S LIVELIHOODS AUGMENTED BY THE PICO-SOLAR SECTOR

## 6 million

FULL TIME JOB EQUIVALENT IN SAVINGS FROM FULLY SWITCHING FROM FUEL-BASED LIGHTING TO SOLAR LIGHTING<sup>19</sup>

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

702 million people still live under the extreme poverty line of \$1.90 per day, half of whom live in Sub-Saharan Africa, and a third of whom live in South Asia.<sup>1</sup> UN SDG 1 targets the complete eradication of extreme poverty by 2030<sup>2</sup>, and decentralized renewables are indispensable for achieving that goal.

### Decentralized renewables helps families living in the world's poorest communities save money:

- » In East Africa, switching from expensive kerosene, torches and candles to solar lights saves families an average of \$70, or 10% of their income, each year. With more money they can buy food, pay for education, and invest in their livelihoods.<sup>3</sup>
- » Globally, cumulative savings from switching from more expensive alternatives to solar lighting have been calculated at over \$3.5 billion.<sup>4</sup>
- » 200,000 people in 300 villages in India—now powered by biogas-powered mini-grids—save around US\$50 per household per year.<sup>5</sup>
- » In the Philippines, the average solar lantern customer saves \$80 per year, mainly due to savings on kerosene.<sup>6</sup>
- » Switching from diesel generators to renewable sources of energy provides savings for farms and businesses. For example, solar powered water pumps are anticipated to save \$14,000 per acre per year through savings on labor, fuel and fertilizer.<sup>7</sup>
- » Additional savings can be made through the knock on impacts of greater power services in unelectrified areas. For example, travel costs for phone recharging can make up to 50% of a person's expenditure on their phone; being able to recharge mobile phones closer to home can therefore provide savings to families and businesses.<sup>8</sup>

### Decentralized renewables are also reducing poverty by driving income generation:

- » In one study of micro-grid hydropower in Peru, income was found to increase for 60% of connected families, with 23% increasing their income by more than 50%.<sup>9</sup>
- » Through selling solar lights, 600 solar agents in East Africa have had their incomes augmented by 30% on average.<sup>10</sup>
- » In the Philippines, the 37% of solar lantern customers who reported working additional hours at night reported earning, on average, \$340 in additional income each year, equal to 18% of their income. The bulk

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Lifting People Out Of Poverty

---

### \$40 billion

IN ANNUAL ENERGY SAVINGS IF ALL HOUSEHOLDS USING KEROSENE AND CANDLES FOR LIGHTING SWITCHED TO SOLAR LIGHTS

### 1.6 million

PEOPLE'S LIVELIHOODS AUGMENTED BY THE PICO-SOLAR SECTOR

### 6 million

FULL TIME JOB EQUIVALENT IN SAVINGS FROM FULLY SWITCHING FROM FUEL-BASED LIGHTING TO SOLAR LIGHTING<sup>17</sup>

of this increase comes from sari-sari store owners who can earn up to \$4 more per day with the use of solar lighting.<sup>11</sup>

- » Up to 20% of SHS customers in some districts of Uganda use their SHS for income generating activities, such as charging mobile phones for their neighbors.<sup>12</sup>
- » Globally, the pico-solar sector is estimated to already support the livelihoods of 1.6 million people, either through direct employment or through the use of pico-solar products for their businesses.<sup>13</sup>
- » To fully support off-grid households, 2 million jobs in the solar LED sector stand to be created, compared to 150,000 jobs that currently exist in the fuel-based lighting sector.<sup>14</sup>
- » In Zimbabwe, after solar irrigation pumps were installed for smallholder farmers, household incomes increased by 286% for the very poor, 173% for the poor and 47% for middle-income groups.<sup>15</sup>
- » In India, salt farmers who previously spent 40% of their annual revenue on diesel fuel were able to increase their annual savings rate by 161% by using solar pumps.<sup>16</sup>
- » For more facts and statistics on the ways that DRE is increasing jobs, income and productivity please follow the link below:

[Fact Sheet: Jobs and Decentralized Renewable Energy](#)

#### Share the Message

Distributed renewable energy saves families money and can augment their income earning capacity in novel ways, and as such, will be an integral part of achieving poverty eradication in accordance with UN SDG 1. Join Power for All to share these messages:

- » Replacing kerosene lamps with solar lanterns saves families money on fuel, allowing them to purchase other goods and services to stimulate the local economy.
- » Distributed renewable energy can create millions more jobs than traditional fossil fuels, both directly and indirectly.
- » Distributed renewable energy can increase incomes for families, smallholder farmers, and business owners, driving economic development.

---

#### Sources:

1. World Bank (2015) "World Bank Forecasts Global Poverty to Fall Below 10% for First Time; Major Hurdles Remain in Goal to End Poverty by 2030" (Accessed 29 October 2017) 2. UN (2016), Sustainable Development Goals (Accessed 19 February 2017) 3. SolarAid (2016), *SolarAid Impact Report 2015*, pg. 4. 4. Global Off Grid Lighting Association (2016), *Social Impact Report July – December 2015*, pg. 7. 5. Husk Power Systems, Accessed 19 February 2017 6. Stiftung Solarenergie (StS) & Hybrid Social Solutions (HSSI) (2011), *Social Impact Assessment, Final Report*, pg. 41. 7. REEEP (2015) *Powering Agrifood Value Chains*, pg. 21. 8. GVEP (2011), *Phone Charging Micro-businesses in Tanzania and Uganda*, pg. 19 9. Practical Action (2014), "Practical Action, Peru / Micro-hydro electrifies remote Andean villages". (Access 29 October 2017). 10. SolarAid (2016), *SolarAid Impact Report 2015*, pg. 4. 11. Stiftung Solarenergie (StS) & Hybrid Social Solutions (HSSI) (2011), *Social Impact Assessment, Final Report*, pg. 52. 12. Veolia Institute (2016), *Decentralized Electrification and Development*, p. 108 13. Global Off Grid Lighting Association (2016), *Social Impact Report July – December 2015*, pg. 6. 14. Mills, Evan (2016), "Job creation and energy savings through a transition to modern off-grid lighting", *Energy for Sustainable Development* vol. 33 15. Oxfam (2015), *Transforming Lives in Zimbabwe: Rural Sustainable Energy Development Project*, pg. 16. 16. SEWA and NRDC (2015) *Worth Their Salt: Draft Case Study for Clean Energy Access in the Salt Marshes of Gujarat* - Parts 1 and 2 17. 14. Mills, Evan (2016), "Job creation and energy savings through a transition to modern off-grid lighting", *Energy for Sustainable Development* vol. 33

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Boosting Agriculture and Improving Nutrition

---

### POWER FOR ALL

# 300%

INCREASE IN AGRICULTURAL  
YIELDS WITH SOLAR WATER  
PUMPS IN KENYA

# 75%

REDUCTION IN GRAIN  
PROCESSING TIME IN NEPAL  
WITH MICRO-HYDRO-POWERED  
MECHANIZATION

# 66,000

PEOPLE IN BENIN WITH ACCESS  
TO FRESH FRUITS AND  
VEGETABLES DUE TO SOLAR  
IRRIGATION

One in 9 people—795 million people—are undernourished<sup>1</sup>, 98 percent of whom live in emerging economies.<sup>2</sup> UN SDG 2 targets the end of hunger and all forms of malnutrition by 2030, as well as the doubling of agricultural productivity and incomes of small-scale food producers.<sup>3</sup> Decentralized renewable energy (DRE) solutions can aid subsistence and low-income farmers to increase outputs, create savings, and allow for increased income for spending on more nutritious food.

### **DRE solutions are increasing food supplies and supporting agricultural output:**

- » Food is the number one good purchased by families in East Africa use savings from replacing kerosene, candles, or flashlights with solar lights.<sup>4</sup>
- » There are 500 million subsistence farmers/smallholders providing food to support 2 billion people with the potential to increase their yields with the use of decentralized renewables.<sup>5</sup>
- » In Kenya, solar irrigation helps smallholders grow more crops throughout the year, leading to an increase in their yields of 300 percent.<sup>6</sup>
- » To increase farming outputs, India has announced plans to install 26 million solar water pumps<sup>7</sup>, while Bangladesh has set a target to finance 50,000 solar water pumps.<sup>8</sup>
- » 11 half-hectare sized market gardens powered by solar irrigation in Benin and farmed by co-operatives of 35-45 women each enable 66,000 people to access fresh fruit and vegetables.<sup>9</sup>
- » Solar refrigeration systems can enable the storage and transport of vaccines for livestock, helping to protect farm animals from diseases like the “peste de petits ruminants” disease, which causes over \$2 billion in losses each year, mainly in Africa, Asia, and the Middle East.<sup>10</sup>
- » In Zimbabwe, solar irrigation pumps allow smallholder farmers to increase yields by 25%. Farmers were able to plant three crops per year, providing a diversity of nutritious cash crops.<sup>11</sup>
- » DRE can increase the value of agricultural products. For instance, using solar dryers to create banana chips in Thailand can increase the price of banana chips sold by over 70%, resulting in increased income of \$1.5 million per year.<sup>12</sup>

### **DRE solutions are reducing wasted food and labour through cooling and agro processing:**

- » The total value of food that is lost annually due to lack of refrigeration is \$4 billion throughout all of Africa and \$4.5 billion in India. In Sub-Saharan Africa, loss of perishable fruits and vegetables can reach up to 50% annually.<sup>13</sup>

### **Join the conversation:**

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Boosting Agriculture and Improving Nutrition

---

### 300%

INCREASE IN AGRICULTURAL YIELDS WITH SOLAR WATER PUMPS IN KENYA

### 75%

REDUCTION IN GRAIN PROCESSING TIME IN NEPAL WITH MICRO-HYDRO-POWERED MECHANIZATION

### 66,000

PEOPLE IN BENIN WITH ACCESS TO FRESH FRUITS AND VEGETABLES DUE TO SOLAR IRRIGATION

- » Cold storage units powered by decentralized renewables save crops following harvest. In a trial in Zimbabwe, biogas powered chillers doubled the amount of milk a family is able to keep or sell.<sup>14</sup>
- » In Uganda, where 70 percent of the population is involved in small-holder agriculture, solar powered refrigeration could cut agricultural output loss by 30–50 percent.<sup>15</sup>
- » Currently, only 10% of global farm labor relies on machines.<sup>16</sup> Using decentralized renewable energy can increase productivity and speed up agricultural processing.
- » In Vanuatu, it takes only a few seconds to grate and grind coconut and cassava using solar-powered machinery, opposed to 20 minutes required with manual grinders.<sup>17</sup>
- » Micro-grid hydro plants powering grain mills in Nepal reduce the time and workload of women by over 75 percent, from at least 2 hours of grain processing by hand, to half an hour with mechanization.<sup>18</sup>
- » After installation of solar water pumps, women in Zimbabwe who previously spent 6 hours per day walking to collect water for their gardens—containing crops like spinach, cabbage, tomatoes, beans, and others—now only spend 1-2 hours daily.<sup>19</sup>
- » Solar refrigeration systems used to keep food fresh can also provide cryogenic energy storage, ensuring more reliable electricity supply.<sup>20</sup>

### Share the Message

The role of decentralized renewables in improving irrigation, cold storage, and agricultural yields will be imperative to reach UN SDG 2 targets for hunger eradication, especially as climate change is projected to increase droughts and extreme weather. Join Power for All to share the following messages:

- » Decentralized renewables, especially solar irrigation and water pumps, can increase agricultural outputs, as well as increase diversity of crop production.
- » Decentralized renewables can power cold storage systems, drastically reducing food waste and preserving more food for people to eat.
- » Mechanized agro processing powered by distributed renewables can save labor and increase the value of crops.

---

#### Sources:

1. WFP (2015) [Zero Hunger](#) 2. World Hunger (2016) [2016 World Hunger Facts and Statistics](#) 3. UN (2016) Accessed 20 February 2017 4. (SolarAid, 2015) 5. Cambridge <http://www.cam.ac.uk/research/news/how-do-smallholder-farmers-fit-into-the-big-picture-of-world-food-production> 6. (Sun Culture) 7. [IEEE](#) (2014) 8. [Cleantechica](#) (2015) 9. SELF (2015) Experiences from the Solar Market Garden (SMG) Project in Benin 10. IRENA (2015) Decentralized Solutions in the Agri-Food Chain, p. 27 11. Oxfam (2015) Transforming Lives in Zimbabwe: Rural Sustainable Energy Development Project 12. IRENA (2015) Decentralized Solutions in the Agri-Food Chain, p. 52 13. Institution of Mechanical Engineers (2014) A Tank of Cold: Cleantech Leapfrog to a More Food Secure World, p. 9 15. SNV 16. [REEEP](#) (2015) Powering Agrifood Value Chains 17. Practical Action (2015) The Energy-Water-Food Nexus at Decentralized Scales 18. IRENA (2014) Capacity Building for Solar Agro-Processing 19. [Mahat, 2004](#) 20. Oxfam (2015) Transforming Lives in Zimbabwe: Rural Sustainable Energy Development Project 21. Institution of Mechanical Engineers (2014) A Tank of Cold: Cleantech Leapfrog to a More Food Secure World, p. 4

---

# POWER FOR ALL FACT SHEET:

## Keeping Families Healthy and Safe

---

# POWER FOR ALL

## 63%

PEOPLE FEELING  
HEALTHIER WHEN NO  
LONGER USING KEROSENE

## 542

HEALTH CENTERS  
POWERED BY SOLAR  
IN CHHATTISGARH

## 284,000

REFUGEES SAFER DUE  
TO SOLAR LANTERNS  
& STREET LIGHTS

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

A lack of electricity for health, sanitation, and security has significant impacts on health and safety, as do the open—and often toxic—flames of candles and kerosene lamps used by many families to light their homes.

### **Decentralized renewables are reducing the use of dangerous forms of lighting and increasing health-related knowledge**

- » Kerosene lamps contribute to indoor air pollution which kills more than 4 million people each year<sup>1</sup>
- » Kerosene ingestion is the number one cause of child poisoning<sup>2</sup>
- » In South Africa alone, more than 200,000 people are injured or lose property annually due to kerosene-related fires<sup>3</sup>
- » In a study in East Africa, 63 percent of people who switched from kerosene lamps to solar lights reported an improvement in their health<sup>4</sup>
- » A micro hydro scheme in Nepal saw a 72 percent drop in kerosene use, reducing smoke and damaging air particles in homes<sup>5</sup>
- » Replacing kerosene and candles with solar lamps is estimated to reduce the probability of fire by 70 percent, and of burn injuries by 80 percent<sup>6</sup>

### **Decentralized renewables power clean water supplies and sanitation, vital to reducing illness**

- » 783 million people lack access to clean water, leading to water borne diseases and diarrhea<sup>7</sup>
- » 44 pilot sites for solar powered water dispensers help 100,000 people in East Africa access safe water,<sup>8</sup> while similar technology enables 300,000 people to access clean water in 12 Indian states<sup>9</sup>
- » In Turkana, Kenya—a single solar powered water pump provides 30,000 liters of clean water a day, saving villagers a 10 kilometer walk to source water from dried-up, contaminated river beds<sup>10</sup>
- » In South Africa, an estimated 300,000 wind pumps are used to provide clean water for household use, irrigation, and livestock<sup>11</sup>



---

# POWER FOR ALL FACT SHEET:

## Keeping Families Healthy and Safe

---

### By the Numbers:

# 63%

PEOPLE FEELING  
HEALTHIER WHEN NO  
LONGER USING KEROSENE

# 542

HEALTH CENTERS  
POWERED BY SOLAR  
IN CHHATTISGARH

# 284,000

REFUGEES SAFER DUE  
TO SOLAR LANTERNS  
& STREET LIGHTS

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

- » Decentralized renewables enable innovative clean water initiatives. A solar powered water filtration pilot in La Mancalona, Mexico, provides 1,000 liters of safe water a day to the village's 450 residents,<sup>12</sup> while new decentralized solar desalination technology in India aims to help 250 million people currently drinking salty groundwater<sup>13</sup>
- » Decentralized renewables improve sanitation. 57 bio centers in Nairobi use the methane from human waste to provide clean bio-fuel, providing sanitation and power in the city's slum areas,<sup>14</sup> whilst solar pumps are used to pump sewage<sup>15</sup>

### Decentralized renewables provide critical energy for health services and medical equipment

- » Around 1 billion people worldwide are served by health centers and hospitals which lack access to electricity<sup>16</sup>
- » 36,000 women in Nigeria die in childbirth each year, with life-saving medical care hampered by a lack of adequate lighting after dark. A trial of solar lights and systems by midwives in 36 of the country's primary healthcare centers led to improvements in service delivery<sup>17</sup>
- » 1,000 solar suitcases help midwives in unelectrified clinics across Africa perform obstetric procedures throughout the night<sup>18</sup>
- » Decentralized renewables power refrigeration, hot water and equipment. In Chipendeke, Zimbabwe, power from a micro hydro plant to the local health center enables vaccines to be refrigerated, which has led to a 75 percent increase in children's vaccinations,<sup>19</sup> while electric boilers enable the sterilization of equipment<sup>20</sup>
- » In the Indian state of Tripura, 80 public health centers, 13 sub-divisional hospitals, and many district hospitals are powered by decentralized solar (almost 90 percent of the public health centers in the state), while in the state of Chhattisgarh, 542 primary and community health centers in insurgency-prone areas are powered by solar<sup>21</sup>
- » To improve health services, Bangladesh aims to power 18,000 rural health centers with decentralized solar systems by 2021<sup>22</sup>

### In remote communities and areas of conflict, decentralized renewables improve the safety of men, women, and children

- » When solar systems were installed in 8 primary schools in Uganda, the percentage of students feeling "scared" or "unsafe" declined from 85 percent to less than 1 percent. They also felt safer using latrines at night, leading to greater use of facilities and improved sanitation<sup>23</sup>

---

# POWER FOR ALL FACT SHEET:

## Keeping Families Healthy and Safe

---

### By the Numbers:

# 63%

PEOPLE FEELING  
HEALTHIER WHEN NO  
LONGER USING KEROSENE

- » Prior to using a solar light, 64 percent of participants in a survey in Haiti did not feel safe during evening hours. Only 2 percent remained concerned after receiving a solar light, with 91 percent reporting they felt very safe walking around their home at night. Participants also reported a dramatic decline in fire hazards and theft incidences<sup>24</sup>
- » 284,000 refugees and members of host communities in Ethiopia and Jordan live in greater safety at night thanks to the provision of more than 56,000 solar lanterns and installation of 720 solar street lights<sup>25</sup>

# 542

HEALTH CENTERS  
POWERED BY SOLAR  
IN CHHATTISGARH

### Share the Message:

Development targets relating to health, safety, clean water, and sanitation will not be met without decentralized renewables. Clean energy technologies make it possible to operate hospitals, power fresh water pumps, reduce toxic indoor air pollution, and far more. Join Power for All and share these messages:

# 284,000

REFUGEES SAFER DUE  
TO SOLAR LANTERNS  
& STREET LIGHTS

- » Hundreds of millions will be left without clean water, access to health care, and safe lighting without decentralized renewables
- » Decentralized renewable technologies already save lives, and improve the welfare of millions of people living in the world's poorest and most vulnerable communities
- » To create a safer and healthier world, in which all have an opportunity to prosper, we must accelerate access to decentralized renewables

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

---

### Sources:

1. World Health Organization (2012) Power for All (2014) The Energy Access Imperative
2. UNICEF (2015) Why Sustainable Energy Matters to Children
3. Mills, E. (2012) Health and Safety Benefits of Modern Off-Grid Lighting
4. SolarAid Research, 2012-2015
5. Practical Answers to Poverty (2002) Pinthali Micro-Hydro Project Nepal
6. Furukawa, C (2012) Health and Safety Benefits of Replacing Kerosene Candles by Solar Lamps: Evidence from Uganda
7. World Health Organization (2012)
8. UNFCCC (2015) Lifelink Water Solutions
9. Piramal (2016)
10. Practical Action. Retrieved 1 October 2016: <http://practicalaction.org/solarpump>
11. REEEP. Module 2, The Energy Sector in Africa. Retrieved 1 October 2016: <http://africa-toolkit.reEEP.org/modules/Module2.pdf>
12. TreeHugger (2015) Solar-powered water purification system a huge success in Mexican village
13. Phys.org (2016) Researchers design a solar-powered desalination device for rural India
14. The Guardian (2014) Poo power: turning human waste into clean energy in Kenya's slums
15. Dwc-water.com. Retrieved 1 October 2016
16. Practical Action (2013) Poor People's Energy Outlook 2013
17. Lighting Africa (2015) Pilot Project Confirms Benefits Of Solar Lanterns To Maternal Care In Nigeria
18. We Care Solar (2016)
19. EuropeAid. Retrieved 1 October 2016: [http://ec.europa.eu/europeaid/documents/case-studies/southern-africa\\_environment\\_microhydro\\_en.pdf](http://ec.europa.eu/europeaid/documents/case-studies/southern-africa_environment_microhydro_en.pdf)
20. Practical Action. Retrieved 1 October 2016 <http://practicalaction.org/benefits-of-urban-life-chipendeke>
21. Oxfam India (2016) Solar for Powering Health and Education in India
22. Bangladesh Sustainable and Renewable Energy Authority (2016)
23. War Child & BBOXX (2015) THE IMPACT OF SOLAR LIGHTING ON EDUCATIONAL OUTCOMES IN 8 PRIMARY SCHOOLS IN NORTHERN UGANDA
24. MPowered (2013) Assessing the Social, Economic and Environmental Impact of Luci Solar Lights in Haiti
25. UNHCR (2015) IKEA stores around the world to raise funds to brighten lives for refugees

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Education

---

---

# POWER FOR ALL

---

# 45%

INCREASE IN STUDY TIME  
WITH SOLAR LIGHTS

# 68%

INCREASE IN FUNCTIONALITY  
OF SCIENCE LABS AFTER  
SOLAR SYSTEM INSTALLED

# 172

PUBLIC SECONDARY  
SCHOOLS IN NIGERIA  
POWERED BY SOLAR

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

Decentralized Renewable Energy (DRE) solutions are helping millions of school children reach their potential

More than 291 million children worldwide go to primary schools without any access to electricity.<sup>1</sup> In Sub Saharan Africa, 90 percent of children attend schools without power.<sup>2</sup> Even though more than 95 percent of villages in India are electrified, 40 percent of schools in the country do not have electricity.<sup>3</sup> Children are also restricted in their education by a lack of lighting and access to information in the home. DRE solutions allow students to study for longer, improve students' test scores, and enable students to access more educational material through use of ICT.

### DRE powers study time, schools and educational institutes:

- » In Uganda, exam scores improved in 8 primary schools with solar systems, with the number of students earning the highest marks on Primary Leaving Exams doubling in some cases. Boys' enrollment also increased by 63 percent, with girls' enrollment increasing by 29 percent<sup>4</sup>
- » 80% of SHS customers in Uganda reported that their children spend more time studying after installation of their SHS, on average an additional 11 hours per week. Of those, 80% report "improved grades" as a result of extra study hours, helping close the educational gap between on-grid and off-grid students.<sup>5</sup>
- » In the Philippines, study time increased by 45% with the introduction of solar lights, and 97% of parents thought their children were showing increased educational motivation.<sup>6</sup>
- » Headteachers whose students have solar lights report improvements in performance, attendance, concentration, and motivation<sup>7</sup>
- » 172 public secondary schools in rural and peri-urban parts of Lagos State in Nigeria are now powered by decentralized solar<sup>8</sup>, while in Bangladesh, the government aims to add 40MW of solar power to remote educational institutes<sup>9</sup>

### DRE is providing children with qualified teaching and more information:

- » Recruitment of qualified teachers to rural schools is often a challenge. In a study from East Africa, 75 percent of headteachers reported that recruiting and/or retaining teachers was a problem. 60 percent felt that better lighting at home would encourage teachers to live and work in rural areas<sup>10</sup>
- » Solar-powered wifi systems have been built for schools in Panama and Senegal, helping to increase internet access and close the digital

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Education

---

### By the Numbers:

# 45%

INCREASE IN STUDY TIME  
WITH SOLAR LIGHTS

# 68%

INCREASE IN FUNCTIONALITY  
OF SCIENCE LABS AFTER  
SOLAR SYSTEM INSTALLED

# 172

PUBLIC SECONDARY  
SCHOOLS IN NIGERIA  
POWERED BY SOLAR

divide for students.<sup>11</sup>

- » Computing hubs in schools and villages powered by decentralized renewables help children access information services. For instance, micro-grid-hydro is powering IT hubs in Afghanistan, Nepal, and Peru.<sup>12</sup>
- » Solar Powered Internet Schools have been built in Botswana, Ethiopia, Gabon, Kenya, Nigeria, Rwanda, South Africa, Tanzania and Uganda, which use solar power to power technology like mobile devices, e-boards, and educational software that enhance students' educational experiences.<sup>13</sup>
- » Improvements to basic communications link children to the wider information economy. 95 percent of solar home system users in Bangladesh reported that their access to information through mobile phone-TV or radio had been improved by their solar home system<sup>14</sup>
- » Solar powered internet cafes made out of shipping containers have been built in Ghana, Kenya, Nigeria, Togo, Zimbabwe, and Colombia, including remote areas with large numbers of displaced peoples and refugees, allowing students and educators to access information and other educational materials online.<sup>15</sup>
- » After solar systems were installed at schools in Nigeria, 68% of schools with integrated science labs reported improvements in functionality of their labs, as did 63% of schools with computer labs, allowing students greater access to ICT and science education throughout the day.<sup>16</sup>

### Share the Message

Lack of electrification in schools negatively impacts students' learning in off-grid communities. Decentralized renewable energy allows students to study more, improves students' motivation to learn, and gives students access to more qualified teaching and educational materials. Join Power for All to share the following messages:

- » Solar lighting in homes allows students to study for longer at night, improving their educational performance.
- » Decentralized renewables in schools give students and teachers access to ICT and other educational technologies in the classroom, decreasing the digital divide between off- and on-grid children.

---

### Sources:

1.) Practical Action, "[Total Energy Access](#)" (Practical Action, 2013) UNDESA (2014), [Electricity and education: The benefits, barriers, and recommendations for achieving the electrification of primary and secondary schools](#), p. 3 3.) CEEW (2016), [Solar for Powering Health and Education in India](#), p. 10 4.) BBOX (2015), [The Impact of Solar Lighting on Educational Outcomes](#), p. 1 5.) Veolia Institute (2016), [Decentralized Electrification and Development](#), p. 110 6.) Stiftung Solarenergie (StS) & Hybrid Social Solutions (HSSI) (2011) [Social Impact Assessment, Final Report](#), p. 53 7.) SolarAid (2016), [SolarAid Impact Report 2015](#), p. 4. 8.) Solar Nigeria, "[Lagos Solar Project](#)" 9.) CEEW (2016), p. 16 10.) SolarAid (2016), p. 4 11.) Principal Solar Institute (2010), [Shining Light on Renewable Energy in Developing Countries](#) 12.) Source 13.) Samsung, "[Samsung Solar Powered Internet Schools Showcased at UNESCO World Education Forum](#)", 6/4/2015 14.) Tania Urmee and David Harries (2011), "[Determinants of the success and sustainability of Bangladesh's SHS program](#)", *Renewable Energy*, Volume 36, Issue 11, p. 2825 15.) Huffington Post, "[This Container Brings Internet To People In Need, Refugees In Remote Areas](#)", 6/10/2016 16.) Solar Nigeria, "[Solar power provides affordable energy for classrooms, IT lessons and much more](#)", 8/27/2016

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Improving Children's Welfare

---

---

# POWER FOR ALL

---

## 500,000+

NUMBER OF PREMATURE DEATH  
AMONG CHILDREN UNDER 5 DUE  
TO INADEQUATE ENERGY

## 65%

PERCENTAGE OF SSA PRIMARY  
SCHOOLS WITH NO ELECTRICITY

## 1 hr

AVERAGE ADDITIONAL DAILY  
STUDY HOUR PROVIDED BY DRE  
SOLUTIONS

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

By increasing educational opportunity and safety, DRE solutions can play a key role in positively influencing children's welfare.

### Poor indoor air quality drastically affects children's health.

- » Inadequately met energy needs, or unsafe and unsustainable energy sources contribute to over 500,000 children under 5 dying annually. Almost 50% of pneumonia deaths for children under 5, specifically, are caused by particulate matter from indoor air pollution.<sup>1</sup>
- » Schools and hospitals also rely on conventional fuels for heating and cooking, extending the problem of indoor pollution far beyond the home into other spaces where children spend time.<sup>2</sup>
- » Indoor air pollution is also connected to low birth weight, tuberculosis, heart disease, and various types of cancer.<sup>3</sup>

### DRE increases children in-door safety by replacing the dangerous use of indoor fuel such as kerosene and candles for lighting.

- » Unguarded candles and wick lamps are a particular danger to children. WHO lists fire-related deaths as one of the leading causes of deaths among children and young adults aged 5-29.<sup>4</sup>
- » Burns are the fifth most common cause of non-fatal childhood injuries. In Bangladesh alone, 173,000 children are moderately or severely burnt each year.<sup>5</sup>
- » DRE offers a cost-effective and safe alternative. Since 2010, more than 130 million DRE solutions have provided improved energy access and lighting for over 360 million people across the world. This has resulted in USD 5.2 billion in economic savings for these customers switching from kerosene and other conventional fuel sources.<sup>6</sup>

### DRE increases study hours for children through improved availability of lighting and improves energy access for schools.

- » Only 35% of sub-Saharan African (SSA) primary schools, serving 90 million students, have access to electricity.
- » A case study from Bangladesh found that teachers point to low light as a major impediment to conduction lessons.<sup>8</sup>
- » Electricity access in schools can not only influence school attendance and teacher retention--through heating, cooling, and lighting--but also powers components essential to higher quality of instruction such as laptops, internet, and other ICT devices.<sup>9</sup>
- » A pilot project in the Philippines has found that electrifying schools through off-grid PV systems has enabled teachers to continue lessons through inclement weather, connect classrooms to internet resources, and reduced student absenteeism.<sup>10</sup>
- » Lack of lighting in the home can also directly result in reduced study hours that can in turn lead to reduced educational attainment.<sup>11</sup>
- » DRE products provide critical lighting hours that enable additional studying hours for children. Acumen recently found that DRE products increased children's daily study by one hour on average.<sup>12</sup>

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Improving Children's Welfare

---

### By the Numbers:

# 500,000+

NUMBER OF PREMATURE DEATH  
AMONG CHILDREN UNDER 5 DUE  
TO INADEQUATE ENERGY

# 65%

PERCENTAGE OF SSA PRIMARY  
SCHOOLS WITH NO ELECTRICITY

# 1 hr

AVERAGE ADDITIONAL DAILY  
STUDY HOUR PROVIDED BY DRE  
SOLUTIONS

» Similarly, research conducted in Bhutan showed that children from electrified homes spend 274 more days in school and spend an additional 8-10 minutes in daily study time than children from unelectrified homes.<sup>13</sup>

### DRE can reduce the risk of violence children face outside their homes.

- » Reliance on conventional fuel pushes children and especially girls to spend hours gathering fuel for lighting and other energy use, putting them at risk of injury and violence.<sup>14</sup>
- » Moreover, the lack of adequate lighting puts women and girls at increased risk of gender-based violence.<sup>15</sup>
- » Research conducted in Madagascar found that, while lighting through electrification helps children of both genders, it benefits girls more since they devote more time to household work and, therefore, can "earn back" more hours through electrification.<sup>16</sup>
- » When solar systems were installed in 8 primary schools in Uganda, the percentage of students feeling "scared" or "unsafe" declined from 85% to less than 1%. They also felt safer using latrines at night, leading to greater use of facilities and improved sanitation!<sup>17</sup>

### Children deserve the resources to stay safe and pursue their dreams. DRE provides new ways for children to be safer and devote their time to new opportunities. Join Power for All and share the following message.

- » DRE can replace the use of dangerous indoor fuels and protect children from burns and injuries from fires.
- » Children can enjoy increased educational opportunities and study hours through lighting and electricity provided by DRE solutions. DRE can reduce risk of injuries and violence against children, especially girls, that arise from fuel collection and inadequate lighting.

---

#### Sources:

1. UNICEF, *Why Sustainable Energy Matters to Children* (2015), p.6; p. 10

2. UNICEF, p. 10; 11; 13.

3. UNICEF, p. 10; 11; 13.

4. PPEO (2014), p.5; p.8

5. WHO (2018)

6. GOGLA (2018) p.2

7. Practical Action, *Poor People's Energy Outlook* (2014), p.41

8. Practical Action, *Poor People's Energy Outlook* (2013), p. 15

9. UNICEF, p.14.

10. Devex, "The Link between Electricity and Education", 6/30/2014

11. PPEO (2014), p.29

12. Acumen, *Energy Impact Report* (2017), p. 30

13. Rauniyar, Ganesh & Kumar, Santosh. (2015). Is electrification welfare improving?: non-experimental evidence from rural Bhutan. p. 13.

14. UNICEF (2015), p. 10.

15. UNICEF (2015), p. 15.

16. Rajaona Daka, Karen, & Ballet, Jerome (2011). "Children's education and home electrification: A case study in northwestern Madagascar". *Energy Policy*, 39(5), 2866-2874.

17. War Child/BBOXX (2015) THE IMPACT OF SOLAR LIGHTING ON EDUCATIONAL OUTCOMES IN 8 PRIMARY SCHOOLS IN NORTHERN UGANDA, p. 2; p. 6

# FACT SHEET:

## Empowering Women As Sustainable Energy Leaders

**POWER  
FOR  
ALL**



Energy poverty is not gender-neutral: evidence shows that women disproportionately bear the burden of energy poverty. Distributed renewable energy (DRE) solutions can not only empower women but the sector itself can significantly benefit by proactively integrating women across the value chain as designers, educators, trainers, managers, and entrepreneurs.

# 59%

INCREASED WAGES FOR RURAL WOMEN WITH ENERGY ACCESS IN BRAZIL

### **Women disproportionately bear the burden of electricity poverty:**

- » The lower a country's electricity access rate, the higher its gender inequality index.<sup>1</sup>
- » 85% of the 2 million deaths caused annually by indoor air pollution from burning fuels are deaths of women and children.<sup>2</sup>
- » Over 300,000 women die annually from complications with pregnancy and childbirth.<sup>3</sup> Unreliable electricity in health facilities adversely affects the provision and access to essential life-saving maternal and newborn care services.<sup>4</sup>
- » After disasters and conflicts, women and children in internally displaced person camps that are unlit at night face increased risks of assault and sexual and gender-based violence (SGBV).<sup>5</sup>

# 72%

DECREASE IN PERINATAL DEATHS WHEN USING SOLAR SUITCASES IN HOSPITALS IN UGANDA

### **Distributed renewable energy solutions have the potential to save lives and empower women through enterprise, while encouraging technology uptake more broadly:**

- » **“Solar Mamas,”** illiterate mothers who have been trained as solar engineers by India's Barefoot College, have installed over 45,000 solar home systems in 1,083 villages in 63 countries.<sup>6</sup> In working outside the home, these women become economically empowered, earning as much as \$60 per month.<sup>7</sup>
- » The **Grameen Shakti** project in Bangladesh has trained over 30,000 women to install and maintain over 1 million solar home systems.<sup>8</sup>
- » **Solar Sister's** over 2,400 women entrepreneurs have brought solar lighting, mobile connectivity, and clean cooking solutions to over 800,000 people in Nigeria, Tanzania, and Uganda.<sup>9</sup>
- » **We Care Solar's** 2,000 solar suitcases in over 30 countries are helping midwives and doctors perform obstetric procedures throughout the night.<sup>10</sup> In Uganda, use of solar suitcases in health centers resulted in a 72% decrease in perinatal deaths.<sup>11</sup>

# 83%

WOMEN WITH SOLAR LANTERNS WHO FEEL INCREASED CONTROL OVER FINANCIAL DECISIONS IN TANZANIA

### **Furthermore, evidence shows that distributed renewable energy solutions must involve women across the value chain to have impact:**

- » In Brazil, energy access is strongly correlated with higher incomes for women: rural self-employed women with energy access have over

#### **Join the conversation:**

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

# FACT SHEET:

## Empowering Women As Sustainable Energy Leaders

**POWER  
FOR  
ALL**



### 59%

INCREASED WAGES FOR RURAL WOMEN WITH ENERGY ACCESS IN BRAZIL

### 72%

DECREASE IN PERINATAL DEATHS WHEN USING SOLAR SUITCASES IN HOSPITALS IN UGANDA

### 83%

WOMEN WITH SOLAR LANTERNS WHO FEEL INCREASED CONTROL OVER FINANCIAL DECISIONS IN TANZANIA

twice the income of women without energy access.<sup>12</sup>

- » In South Africa, women's employment rate in electrified villages increased by 13.5%, while men's employment increased by 4%.<sup>13</sup>
- » In Tanzania, women with solar lanterns had more decision-making power and respect in their households and communities. 83% of women with solar lanterns reported increased control over financial decisions, 70% felt more respected in their household, and 64% felt more respected in their community.<sup>14</sup>
- » Traditionally, development finance institutions (DFIs) have focused on large-scale, capital-intensive technology projects to expand energy access, while overlooking household energy uses such as food processing and procurement of water and fuel. Since women do a disproportionate share of household work, this unwittingly perpetuates gender inequalities.<sup>15</sup>

### Energy access policy must do more to directly focus on gender<sup>16</sup>

- » Gender-sensitive approaches to electrification are mainly initiated by international development agencies or NGOs, while current national-level electricity access policies are gender blind.
- » A stronger alignment between energy access policy and gender equality policy can identify how electricity access can be more effective in combating gender inequality.
- » Energy access statistics must be disaggregated by gender: the current unit of analysis for energy access is the household, which masks differences between energy use by women and men.
- » Electrification ministries must collaborate with other ministries in fields such as agriculture, forestry, and rural development to achieve a more integrated approach to energy access.

### Join Power for All and Solar Sister to share the following messages:

- » Energy poverty is not gender-neutral: women disproportionately bear the burden of energy poverty.
- » Women hold tremendous untapped potential to expand the adoption of distributed energy solutions around the world as changemakers, entrepreneurs, trainers and managers.
- » More concerted policy action is needed to ensure that electricity access helps reduce gender inequality.

#### Sources:

1.) Deloitte University Press (2014) [Women, Energy, and Economic Empowerment](#) 2.) UNDP and World Health Organization (2009) "The energy access situation in developing countries" 3.) WHO (2016) Maternal Mortality Factsheet 4.) Essendi, Hildah et al. (2015) "Infrastructural Challenges to Better Health in Maternity Facilities in Rural Kenya: Community and Healthworker Perceptions." *Reproductive Health* 5.) UNHCR (2015) UNHCR Emergency Handbook 6.) Al Jazeera (2014) "India's Barefoot College Lights Up the World" 7.) PRI (2015) "Zanzibar's 'Solar Mamas' flip the switch on rural homes, gender roles" 8.) UNDP (2013) Gender and energy 9.) Solar Sister 10.) We Care Solar (2016) 11.) We Care Solar (2016) 2015 Annual Report, p. 10 12.) Deloitte University Press (2014) [Women, Energy, and Economic Empowerment](#) 13.) Ashden (2012) Does energy access help women? 14.) Miller Center for Social Entrepreneurship (2016) Turning on the Lights: Transcending Energy Poverty Through the Power of Women Entrepreneurs 15.) African Development Bank Group (2016) "Empowering Women and Girls in the Quest for Universal Energy Access for All" 16.) Exploring Factors that Enhance and restrict Women's Empowerment through Electrification (EFEWEE): Scoping study report (2016)



---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Improve Safety for Vulnerable Communities

---

---

# POWER FOR ALL

---

# 91%

PERCENTAGE OF HAITIAN FAMILIES WHO FELT SAFER AFTER INTRODUCTION OF SOLAR LIGHTING

# 20,000

NUMBER OF SOLAR LAMPS DISTRIBUTED AS EMERGENCY AID FOR HURRICANE VICTIMS IN THE PHILIPPINES

# 284,000

JORDANIAN AND ETHIOPIAN REFUGEES SAFER DUE TO SOLAR LANTERNS & STREET LIGHTS

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

Decentralized renewables improve the safety of remote communities, areas of conflict, and post-disaster relief areas.

### Decentralized renewables increase safety for communities

- » Prior to using a solar light, 64 percent of participants in a survey in Haiti did not feel safe during evening hours. Only 2 percent remained concerned after receiving a solar light, with 91 percent reporting they felt very safe walking around their home at night. Participants also reported a dramatic decline in fire hazards and theft incidences.<sup>1</sup>
- » Provision of solar lights and energy-efficient stoves to survivors of Sexual and Gender Based Violence (SGBV) in Somalia resulted in 83% of women feeling better protected from SGBV<sup>2</sup>
- » When solar systems were installed in 8 primary schools in Uganda, the percentage of students feeling “scared” or “unsafe” declined from 85 percent to less than 1 percent. They also felt safer using latrines at night, leading to greater use of facilities and improved sanitation<sup>3</sup>
- » Handheld solar lamps are an important personal resource for women and girls in humanitarian settings, however they must be part of a comprehensive risk-reduction strategy that may also include improved public lighting, improved infrastructure and increased security presence.<sup>4</sup>

### Decentralized renewables increase safety for displaced communities

- » Research demonstrates that after disasters and conflicts, women and children in internally displaced person camps that are unlit at night face increased risks of assault and SGBV. Women and children who collect firewood for cooking, heating, and lighting are especially vulnerable.<sup>5</sup>
- » 284,000 refugees and members of host communities in Ethiopia and Jordan live in greater safety at night due to the provision of more than 56,000 solar lanterns and installation of 720 public solar street lights by the UNHCR within local refugee camps since 2015.<sup>6</sup>
- » To ensure protection risks are reduced, lighting interventions in vulnerable communities must be well funded and well planned, with increased public lighting being accompanied by adequate security presence and patrol.<sup>7</sup>

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Improve Safety for Vulnerable Communities

---

### By the Numbers:

# 91%

PERCENTAGE OF HAITIAN FAMILIES WHO FELT SAFER AFTER INTRODUCTION OF SOLAR LIGHTING

# 20,000

NUMBER OF SOLAR LAMPS DISTRIBUTED AS EMERGENCY AID FOR HURRICANE VICTIMS IN THE PHILIPPINES

# 284,000

JORDANIAN AND ETHIOPIAN REFUGEES SAFER DUE TO SOLAR LANTERNS & STREET LIGHTS

### Decentralized renewables increase safety after disasters

- » Decentralized renewable energy systems are more resilient than centralized grids in the aftermath of natural disasters, during which electricity access is a critical need to ensure that critical communications, health, and basic needs can be provided<sup>8</sup>
- » After Hurricane Matthew devastated Haiti, electric power was restored to a mini-grid within 55 hours, while grid power still had not been restored nearly four months after the hurricane struck, leading customers to turn to solar lamps, kerosene lamps, or candles for lighting.<sup>9</sup>
- » Due to the absence of grid power in the Philippines in the aftermath of Typhoon Haiyan (Yolanda), 20,000 solar lanterns distributed by UNHCR helped increase a sense of safety and normalcy to typhoon victims. The lanterns also allowed for charging of mobile phones, which were used to search for day jobs and fish markets for fishermen, thereby increasing income generation.<sup>10</sup>

### Share the Message

Development targets relating to health, safety, clean water and sanitation will not be met without decentralized renewables. Clean energy technologies make it possible to operate hospitals, power fresh water pumps, reduce toxic indoor air pollution, and far more. Join Power for All and share these messages:

- » Hundreds of millions will be left without clean water and sanitation, access to health care, and safe lighting without decentralized renewables
- » Decentralized renewable technologies already save lives and improve the welfare of millions of people living in the world's poorest and most vulnerable communities
- » To create a safer and healthier world, in which everyone has an opportunity to prosper, we must accelerate access to decentralized renewables

---

### Sources:

1. MPowered (2013) *A Life with Luci: Assessing the Social, Economic and Environmental Impact of Luci Solar Lights in Haiti* p. 18
2. Save the Children/Norwegian Church Aid (2016) *Protecting Women and Girls Against Sexual and Gender Based Violence (SGBV), and Harmful Traditional Practices (HTPs) and Participation of Women In Peace-building*, p. 4
3. War Child/BBOXX (2015) *THE IMPACT OF SOLAR LIGHTING ON EDUCATIONAL OUTCOMES IN 8 PRIMARY SCHOOLS IN NORTHERN UGANDA*, p. 2; p. 6
4. International Rescue Committee. <http://www.safuelandenergy.org/files/IRC%20Haiti-Solar-Light-Evaluation-Research-Brief.pdf>
5. UNHCR (2017) "Sexual and Gender Based Violence (SGBV) Prevention and Response", "Child Protection" UNHCR Emergency Handbook
6. IKEA Foundation (2016), "IKEA Brighter Lives for Refugees Campaign Raises 30.8 million Euros for Renewable Energy Sources for Refugee Families"
7. Submission to the UN UPR(2011) <http://ijdh.org/wordpress/wp-content/uploads/2011/03/UPR-GBV-Final-4-4-2011.pdf>
8. UNDP (2013) *Resilient and renewable energy systems for local government centers and designated resettlement sites*, p. 1
9. Fast Company (2016) "In Haiti, a Startup Is Building 100% Renewable Grids for Towns With No Power" 10/21/2016; EarthSpark International (2017) "Survey Highlights Community Resiliency Post-Matthew"
10. UNHCR (2013) "Typhoon Haiyan: UNHCR solar lamps ease life after dark"

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Supporting Sanitation and Access to Clean Water

---

---

### POWER FOR ALL

---

## 663 million

NUMBER OF PEOPLE WHO LACK ACCESS TO CLEAN WATER

## 2.4 billion

NUMBER OF PEOPLE WHO LACK ACCESS TO IMPROVED SANITATION

## 30,000

LITRES PER DAY: CLEAN WATER PROVIDED BY A SINGLE SOLAR PUMP IN KENYA

#### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

DRE solutions can provide access to clean water and power critical sanitation systems, reducing the risk of diseases and illness.

#### DRE solutions can supply clean water to communities in need:

- » Globally, 663 million people lack access to clean water, leading to water borne diseases and diarrhea<sup>1</sup>
- » 43% of healthcare facilities in Latin America and the Caribbean, 42% of facilities in Southeast Asia, and 16% of facilities in Sub-Saharan Africa lack access to improved sanitation facilities.<sup>2</sup>
- » In Chhattisgarh state, India, 17% of Primary Healthcare Centers (PHCs) reported not having access to adequate supply of water; 37% reported the inadequate supply of electricity as adversely affecting their water supply.<sup>3</sup>
- » In Turkana, Kenya, a single solar powered water pump provides 30,000 liters of clean water a day, saving villagers a 10 kilometer walk to source water from dried-up, contaminated river beds.<sup>4</sup>
- » More than 330,000 wind-powered water pumps, including 300,000 in South Africa, are used to provide clean water for household use, irrigation, and livestock<sup>5</sup>
- » New decentralized solar desalination technology in India has the potential to improve water quality for 250 million people currently drinking salty groundwater.<sup>6</sup> Latest case study shows that a system costing around USD 23,000 supplied enough water to Chelluru village in Andhra Pradesh state, India. The study also noted that further modifications could bring down the price to around USD 12,000.<sup>7</sup>

#### DRE solutions support new and productive ways to deal with waste, providing economic value to waste that may be otherwise left untreated and pollute nearby water sources:

- » 2.4 billion people lack access to improved sanitation facilities and nearly a billion people practice open defecation, leading to water borne diseases and diarrhea.<sup>8</sup>
- » A startup in Kenya uses human waste to produce 8 tons of fuel briquettes per month, providing sanitation and clean cooking fuel that can reduce deforestation and indoor air pollution.<sup>9</sup> At around USD 0.30

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Supporting Sanitation and Access to Clean Water

---

### By the Numbers:

# 663 million

NUMBER OF PEOPLE WHO LACK ACCESS TO CLEAN WATER

# 2.4 billion

NUMBER OF PEOPLE WHO LACK ACCESS TO IMPROVED SANITATION

# 30,000

LITRES PER DAY: CLEAN WATER PROVIDED BY A SINGLE SOLAR PUMP IN KENYA

per kg, briquettes are extremely cost competitive compared to conventional charcoal fuel.<sup>10</sup>

- » 57 bio centers in Nairobi use the methane from human waste to provide clean bio-fuel, providing sanitation and power in the city's slum areas.<sup>11</sup>
- » Sistema Bio is a decentralized biofuel generator that creates biofuel from organic farm waste. More than 3,900 systems installed in Mexico and Kenya are providing power for 23,000 customers.<sup>12</sup>

### Share the Message

Lack of clean water, poor sanitation, and untreated waste pose serious health threats to communities around the world. DRE offers solutions to these problems.

- » DRE can provide clean water to communities by powering water pumps and filtration systems.
- » DRE Waste-to-Energy systems attach economic value to organic waste, encouraging the collection and treatment of waste and preventing water pollution.
- » Distributed solutions can be deployed quickly, cleanly and cost effectively to reach individual households and communities in need.

---

### Sources:

1. WHO/UNICEF (2015) [Progress on Sanitation and Drinking Water, 2015 Update and MDG Assessment](#) p. 4
2. WHO/UNICEF (2015) p. 47
3. CEEW (2017), [Powering Primary Healthcare through Solar in India](#), p. 31
4. Practical Action, [“Solar-powered Water Pumps: Impact”](#)
5. Renewable Energy and Energy Efficiency Partnership (REEEP)/UNIDO [“Module 2: The Energy Sector in Africa”](#), REEP/UNIDO Training Package, p. 2.21
6. Phys.org [“Researchers design a solar-powered desalination device for rural India”](#), 7/18/2016
7. Bian, David (2017), Design, development, and field-testing of a cost-optimized village-scale, photovoltaic-powered, electro dialysis reversal water desalination system for rural India, Massachusetts Institute of Technology, pg. 3.
8. WHO/UNICEF (2015) Progress on Sanitation and Drinking Water, 2015 Update and MDG Assessment p. 5; Foreword
9. IEEE Spectrum, [“Kenyan Startup Uses the Sun to Turn Human Waste into Cooking Fuel”](#), 11/23/2016
10. Sanitation, [“Can I Try It?”](#), 3/17/2014
11. The Guardian, [“Poo power: turning human waste into clean energy in Kenya's slums”](#), 10/15/2014
12. Sistema.bio, [“Impact”](#)

---

# POWER FOR ALL FACT SHEET:

## Making Energy Access Affordable

---

# POWER FOR ALL

## \$22,000

COST OF RURAL GRID  
EXTENSION PER KM

## \$300-400

GRID CONNECTION  
COST IN TANZANIA

## 50¢

DAILY COST OF A  
SOLAR HOME SYSTEM

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

While the central grid is a cost-effective solution for powering highly populated regions, 85% of those currently unelectrified live in rural areas<sup>1</sup> with low population density and low energy demand. The cost of grid extension to these areas is too high. Decentralized renewable energy (DRE) is enabling millions of families and businesses to access energy at a price they can afford, and providing the flexibility to grow with demand.

### DRE provides the most affordable way to power rural areas

- » Rural centralized-grid extension in Africa and Asia can cost up to \$22,000 per kilometer.<sup>2</sup> For example, reaching remote rural areas in Tanzania costs around US\$2,300 per household<sup>3</sup>
- » In contrast, 500,000 people in Mongolia were connected to solar home systems for a approximately \$24 million; \$240 per household<sup>4</sup>
- » Analysis by the International Energy Agency (IEA) finds that 70 percent of those in rural areas are more affordably reached by mini-grids and other decentralized solutions<sup>5</sup>
- » Recent research estimates that even greater use of DRE can reduce the global cost of basic energy access even further; from \$700 billion (IEA estimate)<sup>6</sup> to \$70 billion<sup>7</sup>

### Access via the centralized grid is expensive for utilities, governments and consumers

- » The high cost of grid extension creates a challenge for overstretched utilities in Asia and Africa, leaving many in a “chronically weak financial position”<sup>8</sup>
- » To operate, many utilities rely on subsidies from government. For example, in India, government expenditure on electricity subsidy is \$2.8 billion a year<sup>9</sup>, while in Africa subsidies for utilities and kerosene are \$21 billion a year<sup>10</sup>
- » Even so, tariffs are often too high for consumers to connect. In Tanzania—where 70 percent of the population lives on less than \$2 per day<sup>11</sup>—connection charges range from US\$300-400, and a new service line can cost over \$1000, even before the cost of electricity<sup>12</sup>

---

# POWER FOR ALL FACT SHEET:

## Making Energy Access Affordable

---

### By the Numbers:

# \$22,000

COST OF RURAL GRID  
EXTENSION PER KM

# \$300-400

GRID CONNECTION  
COST IN TANZANIA

# 50¢

DAILY COST OF A  
SOLAR HOME SYSTEM

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

### DRE is critical for ending energy poverty

- » The affordability of Tier 1-2 basic energy access<sup>13</sup> is allowing millions of homes and businesses to access clean, reliable power for the first time<sup>14</sup>
- » Quality solar lanterns cost as little as \$5,<sup>15</sup> while solar home systems can be paid for in installments of 50 US cents a day<sup>16</sup>
- » Larger DRE solutions, which provide higher levels of energy services, are also more affordable. For example, the global average cost of connecting a household to a mini-grid is estimated at \$500,<sup>17</sup> while the average micro-hydro power investment cost per connected household in Nepal is US\$325<sup>18</sup>

### Share the Message

The cost of grid extension is too high. The IEA's estimate of investment needed for total global energy access are between 300-500 percent higher than current investments in energy access, and would constitute 30 percent of all current international aid.<sup>19</sup> More affordable solutions are critical to accelerate the pace of energy access.

Share these key messages to #endenergypovertyfaster:

- » The cost of grid extension to rural areas—where 85 percent of those in energy poverty currently live—is simply unaffordable
- » A greater focus on less expensive alternatives—such as solar home systems and mini-grids—is vital to meet energy access targets, and lift hundreds of millions from energy poverty

---

### Sources:

1. UN Department of Economic and Social Affairs (2014) Improving Sustainable Energy Access for Rural Areas
2. Power for All (2014) The Energy Access Imperative
3. Africa Progress Panel (2015) Power, People, Profit: Seizing Africa's Energy and Climate Opportunities
4. World Bank Group (2012) Solar Power Lights up Future for Mongolian Herders
5. International Energy Agency (2011) Energy for All: Financing Access for the Poor
6. International Energy Agency, United Nations Development Programme, United Nations Industrial Development Organization (2010). Energy Poverty: How to Make Modern Energy Access Universal? (Minimum levels of electricity consumption for access for rural households is assumed to be at least 250kWh per year and urban households 500kWh in the IEA et al. assessment. 250kWh per year represents Tier 2 electricity consumption and 500kWh represents Tier 3 level of electricity consumption in the 2015 Global Tracking Framework)
7. Power for All (2014) The Energy Access Imperative; Persistent Energy Capital (2015) Financing the DESCO S-Curve
8. World Bank Group (2013) Connection Charges and Electricity Access in Sub-Saharan Africa
9. International Institute for Sustainable Development (2012) A Citizen's Guide to Energy Subsidies in India
10. Africa Progress Panel (2015) Power, People, Profit: Seizing Africa's Energy and Climate Opportunities
11. World Bank Group (2015) Tanzania Mainland Poverty Assessment
12. Power, People, Profit: Seizing Africa's Energy and Climate Opportunities (2015), Africa Progress Panel
13. Access to low energy products such as lighting, television, fans, and computers as measured by Sustainable Energy for All, and noted in the Progress Toward Sustainable Energy 2015: Global Tracking Framework Report (2015)
14. Bloomberg New Energy Finance, International Finance Corporation & World Bank Group (2016) Off-Grid Solar Market Trends Report 2016
15. d.light design (2016)
16. M-Kopa (2016)
17. Power for All (2016) Decentralized Renewables: The Fast Track to Energy Access (Illustrative case studies based on real-world data from decentralized renewable energy companies operating today)
18. Vaidya. Cost and Revenue Structures for Micro-Hydro Projects in Nepal. Microhydropower.net: Retrieved 12 September 2016
19. Crane, Mills & Guay (2014) Clean Energy Services for All

---

# POWER FOR ALL FACT SHEET:

## Jobs and Decentralized Renewable Energy

---

# POWER FOR ALL

## 127,000

SOLAR HOME SYSTEM  
JOBS ALREADY IN  
BANGLADESH

## 4.5 million

JOBS IN DECENTRALIZED  
RENEWABLES BY 2030

## 9x more

JOBS IN SOLAR LIGHTING  
THAN FUEL ALTERNATIVES

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

**The decentralized renewable energy (DRE) industry is a largely untapped engine for job and business creation.**

### DRE enterprises create jobs

- » Globally, the decentralized renewable energy industry is expected to create at least 4.5 million direct jobs by 2030<sup>1</sup>
- » 38 jobs are created in the solar-lighting industry for every 10,000 lights sold; this part of the sector alone could create 2 million jobs<sup>2</sup>
- » In contrast, the entire fuel-based lighting sector only enables 150,000 jobs<sup>3</sup>; 9 times fewer
- » Bangladesh's solar home system industry has already created 127,000 direct jobs<sup>4</sup>, while India's employs 72,000 people<sup>5</sup>
- » An additional 50 to 100 percent more jobs are created indirectly for each direct job in the decentralized renewables industry<sup>6</sup>

### Clean energy access leads to growth in the wider economy

- » Reliable, affordable and rapidly available power from DRE boosts output for small to medium sized enterprises (SMEs); in Africa SMEs account for 80 percent of employment<sup>7</sup>
- » Mobisol estimates that 15,000 of its customers who use their systems for business create around \$5 million per year in additional income<sup>8</sup>, while solar mills in Zambia are expected to create 3000 jobs<sup>9</sup>
- » In India 70 percent of micro-businesses signed up to mini-grid services reported an increased number of customers, and 80 percent plan to expand their business because of access to reliable energy<sup>10</sup>

### Share the Message

Electricity is a vital enabler of jobs and businesses. With millions of young people joining the workforce each year, reliable access is ever more urgent. Join Power for All and share these messages:

- » Decentralized renewable energy creates far more jobs than traditional energy
- » Decentralized renewable energy provides a fast and affordable way to power businesses and economic growth
- » To boost employment and enterprise it is vital to fast-track the expansion of decentralized renewable energy solutions

---

# POWER FOR ALL FACT SHEET:

## Jobs and Decentralized Renewable Energy

---

### Sources:

1. IRENA, Renewable Energy and Jobs (2013)
2. E.Mills, Job creation and energy savings through a transition to modern off-grid lighting (2016)
3. E. Mills, Job creation and energy savings through a transition to modern off-grid lighting (2016)
4. IRENA, Renewable Energy and Jobs (2016)
5. IRENA, Renewable Energy and Jobs (2016)
6. IRENA, Renewable Energy and Jobs (2013)
7. World Economic Forum, Why SMEs are key to growth in Africa (2015)
8. Mobisol (2016)
9. Energy Matters, Solar Powered Hammer Mills Arrive In Zambia (2015)
10. Rockefeller Foundation, Sankalp Forum (2016)



---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Supporting Climate Resilience and Adaptation

---

---

# POWER FOR ALL

---

# 9%

SHARE OF TOTAL WATER CONSUMPTION IN INDIA FROM POWER GENERATION BY 2050 IN BAU SCENARIO

# 95%

PERCENTAGE OF BERMUDAN INFRASTRUCTURE AND HOUSING DESTROYED BY HURRICANE IRMA

DRE can help communities to adapt to a fast changing global climate and become more resilient in the face of such disasters.

**Impacts of climate change directly threaten water supply around the world through droughts and changing weather patterns, which can have a severe impact on electricity generation and supply.**

- » Brazil and Zambia--both countries that rely heavily on large hydropower--experienced constraints on electricity supply due to severe droughts<sup>1</sup> in 2015. The problem is not restricted to hydropower since thermal-electric power plants also consume large amounts of water for generation.<sup>2</sup>
- » In 2012, heat waves and monsoon season delay were responsible for major blackouts in India.<sup>3</sup> India faces a particularly acute problem as business-as-usual scenarios predict that by 2050 almost 9% of national water consumption (water removed from source and not returned to water cycle) will be through power generation.<sup>4</sup>
- » DRE technology that does not rely on large scale water consumption can help local and national communities adapt to such changing weather patterns.<sup>5</sup>
- » IRENA research found that a combination of higher share of renewable energy and higher efficiency of cooling technologies in India could reduce water withdrawal intensity (amount of water removed from source) by 84% and water consumption by 25%, in comparison to baseline scenarios.<sup>6</sup>

**Natural disasters of increasing frequency and devastation threaten communities. DRE technology offers a more resilient and cost-effective alternative for many local and national communities.**

- » Caribbean island nations are no longer strangers to mega-weather events that rip through infrastructure. Hurricane Irma of 2017 destroyed 95% of homes and infrastructure on Bermuda and Puerto Rico is still struggling to get its electricity grid back on a stable footing.<sup>7</sup>
- » The traditional grid's transmission and distribution network is highly vulnerable to extreme weather events.<sup>8</sup> Grid disruption, in turn, can bring other critical infrastructure components such as transportation and health services to a halt.
- » By disconnecting from the larger grid when needed and eliminating the need for fuel, DRE technology can add resiliency to electricity supply. Turks and Caicos, for example, reported uninterrupted operation of the island's PV mini-grids even as Hurricane Irma swept through the country in 2017.<sup>9</sup>

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

---

# POWER FOR ALL RESEARCH SUMMARY

## Decentralized Renewables: Supporting Climate Resilience and Adaptation

---

### By the Numbers:

# 9%

SHARE OF TOTAL WATER CONSUMPTION IN INDIA FROM POWER GENERATION BY 2050 IN BAU SCENARIO

» Also, many of the most vulnerable island communities face high electricity costs of around USD 0.20-0.50/kWh due to their geographic restrictions.<sup>10</sup> Transition to DRE technologies can reduce costs for these communities

**Business-as-usual approaches to electricity supply are insufficient in the face of climate change. Join Power for All to share the following messages:**

- » Climate change threatens global water supply, a problem that can be compounded by the large water needs of conventional power generation technology. DRE can help reduce the burden to the planet's water supply.
- » The traditional grid is vulnerable to increasingly extreme weather events. DRE can help create more resilient means of electricity supply in a cost-effective way.

# 95%

PERCENTAGE OF BERMUDAN INFRASTRUCTURE AND HOUSING DESTROYED BY HURRICANE IRMA

---

### Sources:

1. IEA (2015), *Making the Energy Sector More Resilient to Climate Change*, 4
2. IEA, 4
3. IEA, 4
4. IRENA (2018), *Water Use in India's Power Generation: Impact of Renewables and Improved Cooling Technologies to 2030*, 1.
5. IEA, 5
6. IRENA, 9.
7. RMI, "Rebuilding the Caribbean for a Resilient and Renewable Future", 9/15/2017.
8. IEA, 3.
9. RMI.
10. RMI

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Powering a Climate-Friendly Future

---

# POWER FOR ALL

By 2030, replacing toxic kerosene and diesel off-grid generation with decentralized renewable energy (DRE) could save almost a gigaton of CO<sub>2</sub> and CO<sub>2</sub> equivalent (e)<sup>1</sup> each year: the same as the annual CO<sub>2</sub> and CO<sub>2</sub>e emissions of Germany.<sup>2</sup> Given the unprecedented opportunity DRE also presents to drive a sustainable development path and lift 1+ billion people from fuel poverty, it has been dubbed the “low-hanging fruit” of the climate-world.<sup>3</sup>

### Decentralized renewables can combat climate change

- » Eliminating black carbon from kerosene lamps globally can reduce emissions by 240 million tons CO<sub>2</sub>e per year<sup>5</sup>—the same as taking 80 coal power plants offline<sup>6</sup>
- » 4 million solar home systems in Bangladesh already save 1.5 million tons CO<sub>2</sub>e per year due to a reduction in kerosene use<sup>7</sup>—equivalent to taking passenger cars off the road for 3.5 billion miles<sup>8</sup>
- » Eliminating CO<sub>2</sub> and black carbon from diesel mini-grids can reduce emissions by 115 million tons of CO<sub>2</sub> per year<sup>9</sup>—the same as taking 38 coal-fired power stations offline<sup>10</sup>
- » Millions more tons of CO<sub>2</sub> and black carbon will also be eliminated by replacing standalone diesel generators.<sup>11</sup> Per kWh, small diesel generators create 2x the CO<sub>2</sub> emissions of coal power plants<sup>12</sup>
- » The potential avoided emissions per year globally by 2030 due to distributed renewables is estimated as 0.8–0.9 Gt CO<sub>2</sub>e<sup>13</sup>—the same as taking 270–300 coal power plants offline<sup>14</sup>
- » Using a common \$15/tCO<sub>2</sub>e carbon price to put a cost on emissions (a low but commonly used valuation) avoiding 0.8–0.9 Gt CO<sub>2</sub>e is equal to an avoided carbon cost of \$4–4.5 billion each year<sup>15</sup>
- » Smaller, easily deployable and locally maintained distributed renewables are boosting climate-resilience. A month after the devastation of Hurricane Matthew, the grid was still down in areas of Southern Haiti. Solar mini-grids were running in 55 hours<sup>16</sup>

# 1 Gt

CO<sub>2</sub>e COULD BE  
AVOIDED EACH YEAR

# 300

EQUIVALENT NUMBER OF  
COAL PLANTS OFFLINE

# \$4.5 billion

POTENTIAL CARBON SAVING

### Join the conversation:

[powerforall.org](http://powerforall.org)

[twitter.com/power4all2025](https://twitter.com/power4all2025)

[facebook.com/pwr4all](https://facebook.com/pwr4all)

---

# POWER FOR ALL FACT SHEET

## Decentralized Renewables: Powering a Climate-Friendly Future

---

### By the Numbers:

# 1Gt

CO<sub>2</sub>e COULD BE  
AVOIDED EACH YEAR

# 300

EQUIVALENT NUMBER OF  
COAL PLANTS OFFLINE

# \$4.5 billion

POTENTIAL CARBON SAVING

### Share the Message

DRE enhances climate security by providing a safe sustainable alternative to the toxic kerosene and diesel used in hundreds of millions of unelectrified households. Switching to DRE will rapidly reduce emissions, improve lives, and set emerging economies on a critical low-carbon path to energy access. Share these messages with key stakeholders:

- » Switching to decentralized renewables from polluting energy such as kerosene lamps will save almost a Gt CO<sub>2</sub>e each year by 2030—equal to the annual emissions of Germany
- » Due to the extraordinary benefits to the lives of those living in some of the world's poorest communities, replacing toxic kerosene with decentralized renewables has been termed the "low-hanging fruit" of the climate world
- » The energy that will rapidly increase energy access, is the same clean energy that will combat climate change—we must support a radical shift to decentralized renewables

---

### Sources:

1. UNFCCC (2015) Facilitating Technology Deployment in Distributed Renewable Electricity Generation. Estimates based on IRENA analysis of life-cycle GHG emissions, including avoided black carbon emissions due to the replacement of kerosene lamps. Black carbon and other greenhouse gases are measured in CO<sub>2</sub> equivalent to enable comparison with CO<sub>2</sub>
2. Umweltbundesamt (2016) UBA emissions data for 2015 indicate urgent need for consistent implementation of Climate Action Programme 2020
3. Berkeley News (2012) Let there be light
4. Jacobson et al (2013) Black Carbon and Kerosene Lighting: An Opportunity for Rapid Action on Climate Change and Clean Energy for Development. Brookings Institute
5. Lam et al (2012) Household Light Makes Global Heat: High Black Carbon Emissions From Kerosene Wick Lamps. Environ. Sci. Technol., 2012, 46 (24), pp 13531–13538
6. Platform for Energy Access Knowledge (PEAK) analysis - calculated using CO<sub>2</sub>e figures and Koomey et al metric for emissions from an average coal plant; Koomey, J. et al (2010) Defining a standard metric for electricity savings. Environ. Res. Lett. 5, 014017
7. PEAK analysis - calculated using Asaduzzaman et al. analysis of usage of different types of kerosene lamps in Bangladesh and emissions figures for kerosene lamps; Asaduzzaman et al. (2010) Restoring Balance: Bangladesh's Rural Energy Realities
8. US Environmental Protection Agency (2016) Greenhouse Gas Equivalencies Calculator
9. PEAK analysis - calculated using data on diesel based mini-grids from IRENA; "Analysis of Diesel-based Mini-grids for Enabling the Implementation of Renewable Energies" (2012)
10. PEAK analysis - calculated using CO<sub>2</sub>e figures and Koomey et al metric for emissions from an average coal plant; Koomey, J. et al (2010) Defining a standard metric for electricity savings. Environ. Res. Lett. 5, 014017
11. Using Nigeria as just one example, estimates for the number of stand alone diesel generators range from 9 million to 100 million (9 million is noted as a low estimate). 9 million diesel generators have been calculated to produce 29 million tonnes of CO<sub>2</sub>, 100 million would create 320 million tonnes. Millions more generators are found in other countries around the world.
12. Moss, T. & Gleave, M (2014) How Can Nigeria Cut CO<sub>2</sub> Emissions by 63%? Build More Power Plants
13. UNFCCC (2015) Facilitating Technology Deployment in Distributed Renewable Electricity Generation. Estimates based on IRENA analysis of life-cycle GHG emissions, including avoided black carbon emissions due to the replacement of kerosene lamps
14. PEAK analysis - calculated using CO<sub>2</sub>e figures and Koomey et al metric for emissions from an average coal plant; Koomey, J. et al (2010) Defining a standard metric for electricity savings. Environ. Res. Lett. 5, 014017
15. Analysis by PEAK team at UC Berkeley - calculated using conservative carbon cost of \$15/tCO<sub>2</sub>e and a median value IPCC discount rate (8%)
16. Sigora International (2016)

---

# POWER FOR ALL PERSPECTIVE:

## Black Carbon & Energy Access

---

**POWER  
FOR ALL**

**240 MT**

ANNUAL AVOIDED  
CO<sub>2</sub> EQUIVALENT

**10x**

LESS CLIMATE IMPACT

**100x**

BETTER ENERGY SERVICE

**Eliminating black carbon from kerosene lamps globally can reduce emissions by 240 million tonnes CO<sub>2</sub> equivalent per year**<sup>1,2</sup> - the same as avoiding 80 coal fired power stations.<sup>3</sup> Scientists have identified the best way to accomplish this and bring electricity to 1 billion+ people:<sup>4</sup> Use decentralized renewables.

### Climate Cost: Kerosene Lighting

- » Black carbon creates climate warming thousands of times stronger than CO<sub>2</sub><sup>5</sup>
- » Black carbon is thought to be the second-largest contributor to climate change behind CO<sub>2</sub><sup>5</sup>
- » Overall, the climate impacts from kerosene lamps in off-grid households are 10x higher than electricity-related impacts from households on the grid or using off-grid renewables<sup>4</sup>

### The Solution: Decentralized Renewables'

- » Despite a century of efforts, the grid has not met the electricity access challenge<sup>4</sup>
- » Decentralized clean energy systems can rapidly fill this gap - helping over a billion people get access to electricity by 2025<sup>6</sup>
- » As well as reducing dangerous emissions, decentralized renewables enable households to receive 100x more energy service than kerosene lamps<sup>4</sup>

### Share the Message

Taken together, research on the climate impact of kerosene lighting and progress in distributed clean energy have overturned the view "held by some that one must choose between progress on energy access or climate". Rapidly scaling decentralized renewables to replace kerosene can drive universal energy access while immediately reducing toxic emissions.

Our sector must use this knowledge to create a powerful new narrative in its communications with policy-makers, investors and donors, including these key messages:

- » The climate cost is clear: Black carbon from kerosene lamps is a major emissions category that can - and should - be eliminated
- » The energy that will end energy poverty is the same clean energy needed to combat climate change: decentralized renewables!



## Join the Conversation:

powerforall.org

twitter.com/power4all2025

facebook.com/pwr4all

## Raise Your Voice Online

We urge you to join with us and demand both **Climate Action and Power for All**

Use these sample Tweets to tell decision-makers about the incredible power of decentralized renewables:

- 🐦 Decentralized renewables = 10x better for climate and 100x better energy service than kerosene lamps. We need @Power4All2025
- 🐦 How can we make immediate emissions cuts AND lift 1 billion+ from fuel poverty? Off-grid renewables! @Power4All2025
- 🐦 Action on energy access is climate action! RT these key stats on black carbon emissions: <http://bit.ly/1IZBApC> @PowerforAll2025
- 🐦 Decentralized renewables reduce black carbon emissions & drive #energyaccess = no brainer! See more: <http://bit.ly/1IZBApC>
- 🐦 Can Energy Access protect the climate? Yes! By eliminating toxic black carbon. RT the research: <http://bit.ly/1IZBApC> @Power4All2025
- 🐦 Energy access can eliminate emissions equal to 240MT CO2 and lift millions from fuel poverty. RT the facts: <http://bit.ly/1IZBApC>

---

## Sources:

1. Jacobson et al (2013) Black Carbon and Kerosene Lighting: An Opportunity for Rapid Action on Climate Change and Clean Energy for Development. Brookings Institute
2. Lam et al (2012) Household Light Makes Global Heat: High Black Carbon Emissions From Kerosene Wick Lamps. *Environ. Sci. Technol.*, 2012, 46 (24), pp 13531–13538
3. J. Koomey et al (2010) Defining a standard metric for electricity savings. *Environ. Res. Lett.* 5, 014017.
4. Alstone et al (2015) Decentralized energy systems for clean electricity access. *Nature Clim. Change.* 5, 305–314
5. Bond et al (2013) Bounding the role of black carbon in the climate system: A scientific assessment. *Journal of Geophysical Research Letters*
6. Power for All (2014) Available from: [www.powerforall.org/resources](http://www.powerforall.org/resources)