



WORTH THEIR SALT

Improving Livelihoods of Women Salt Farmers through Clean Energy in the Salt Pans of Gujarat

Gujarat, India's westernmost state, produces nearly 76 percent of the nation's salt.¹ On the edge of the Arabian Sea, Gujarat's Little Rann of Kutch (LRK) is a remote desert area of more than 3,000 square kilometers. There is little continuous habitation, and no modern electric grid connectivity.

Today, the majority of the *agariyas* (salt farmers) in Little Rann of Kutch use inefficient water pumps powered by expensive diesel, available at large distances. Diesel fuel accounts for over 40 percent of *agariyas'* annual income.² Each salt pan produces over 600 metric tons of salt annually. Primary dependence on one occupation, meagre savings, and seasonal earnings have led to generational poverty amongst the *agariyas*.³

Enter: solar energy. In 2013, the Self-Employed Women's Association (SEWA), working with women *agariyas*, started a pilot, with a humble 14 pumps, to replace the diesel pumps with solar and solar hybrid pumps. In 2014, SEWA teamed up with the Natural Resources Defense Council (NRDC) to build a business case for scaling the use of solar pumps for salt-farming. SEWA worked with *agariya* women to help them access loans and

BOX 1: ENHANCING THE ROLE OF WOMEN

Self Employed Women's Association (SEWA) started in 1972 as an organization of low-income, self-employed women workers. SEWA has multiple sister-organizations including a bank which work towards enhancing female participation in the labor force.⁴

SEWA started organizing the women salt workers, referred to as *agariya* sisters, in the Little Rann of Kutch in 1992 to educate them on nutrition and child care. Gradually, SEWA's engagement with the *agariya* women expanded into other areas such as savings groups, skills training and leadership enhancement sessions, and financial and livelihood generation activities.



scale this project to more than 1,100 solar-powered pumps in use in Little Rann of Kutch by 2018. (Table 1, Pg.4). This will be expanded to over 15,000 pumps.

SEWA-NRDC analysis shows that switching from diesel to hybrid solar/diesel pumps can increase *agariyas'* annual net income by almost 94 percent (\$538⁵ per salt pan), while also reducing exposure to noxious diesel emissions.

This factsheet also highlights the benefits of reducing diesel use by using solar pumps and describes innovative financial solutions that can be used to provide affordable clean energy access, for many more *agariyas* across LRK.

KEY MESSAGES

- *Agariyas* spend over 40 percent of their annual income procuring diesel for each salt production season. By using a hybrid system based on solar and diesel, purchased on loans, *agariyas* can increase their annual net income to ₹35,000 (\$538) per saltpan, which is 94% more than using a diesel pump. Once the equipment loan is fully paid off, annual net income can increase to ₹80,000 (~ \$1,230).
- The increase in income because of the pilot and SEWA's facilitation have helped *agariyas* to support their children's education and pursue additional income-generating activities such as small flour-mills and cattle. This has ensured asset building & ownership, financial inclusion and improved social recognition of women as bread winners.
- Reducing the diesel used for salt production by 43,000 *agariya* families in the LRK by replacing diesel-powered pumps with hybrid solar/diesel water pumps can avoid up to 115,000 metric tons of carbon dioxide (CO₂) emissions.
- The new pumps will create additional off-grid solar capacity that can help contribute to India's off-grid renewable energy target of 2 gigawatts by 2022,⁶ as well as the government's goal to develop 24/7 energy access for every household by 2019.⁷
- A lack of affordable, widely available financing solutions is a major barrier to scaling off-grid renewable energy use amongst low-income households. However, the SEWA pilot and its scale-up demonstrate replicable innovative financial solutions that can help overcome this challenge.



Agariya women and their families at work in LRK. Intensive manual raking of the drying salt is needed to ensure smaller salt crystals. As the salt is formed and ready, the agariyas pile it up on the side of the pan to transport to the buyer

Here Comes the Sun: The Case for Solar Power in Salt Farming

With nearly 300 sunny days and high solar radiation, India is a solar energy goldmine.⁸ In 2010, SEWA analyzed renewable energy technologies, including off-grid applications, that could reduce costs for brine groundwater extraction.⁹ The analysis considered major factors that could affect large-scale deployment of renewable energy, such as impact on salt production, cost of engines and pumps, equipment maintenance costs, fuel costs and running hours. In the end, solar pumps emerged as the most viable alternative.

To test the technical feasibility, SEWA launched a pilot in 2013 with 14 solar pumps and 14 women salt farmers. The farmers were given zero interest loans through SEWA's district-level association. The participating *agariya* women, reliant only on solar systems (2 *agariyas*) and using hybrid solar/diesel systems (12 *agariyas*), noticed significant expense reduction. SEWA also helped the *agariya* women organize producer cooperatives to bargain for better prices with salt traders and factories. However, financing barriers prevented them from taking this project to scale.

SEWA and NRDC partnered in 2014 to build a business case to bring solar pumps to all *agariya* families. SEWA with support from Sun Edison distributed 200 solar-powered water pumps to *agariyas* in the Little Rann of Kutch. The demonstrated economic, social, environmental, and commercial benefits of replacing diesel pumps with solar have accelerated the expansion of this project.

IDENTIFYING AND SOLVING PROBLEMS

Many micro businesses face challenges in obtaining loans for equipment/technological investments due to risk perceptions of traditional lenders. In this pilot, SEWA and NRDC worked with women *agariyas* to explore ways to attract more government and private financiers (See Box 2).

Based on actual usage by salt farmers, we developed technical specification for efficient solar pumps such as the size of electric motors and solar panels required. We also worked with the Ministry of New and Renewable Energy (MNRE) to include these specifications and *agariyas* as eligible for subsidy.¹⁰ This helped reduce the salt-farmers' upfront costs to purchase the pumps. Next, we also engaged with National Bank for Agriculture and Rural Development (NABARD), the government agency implementing the subsidy, to ensure it reaches the farmers. However, the participating women *agariyas* would still require loans to purchase these pumps.

Deep discussions with leading financiers highlighted the opportunity for sustainable funding for clean energy. This project addressed common barriers to financial access such as lack of identification and address documents,¹¹ insufficient awareness amongst low-income groups about formal banking requirements, and lack of access to loans due to seasonal nature of income earned.

BOX 2: PILOT PROJECT STEPS

- Identifying relevant players – central/state/local government officials, private/public financial institutions, tech experts, tech suppliers
- Understanding household/community needs – building on SEWA's knowledge, more than 5 Focus Group Discussions, and consultations with key community members stakeholders (March 2014 – April 2015)
- Identifying challenges and devising appropriate tech-policy-financing solutions through evaluations and engagement
- Working out multiple comparative scenarios on economic savings potential
- Roundtable/workshop for bankers and financiers
- Demonstrable success leading to scale-up with potential for more

Phases of growth

The solar pump project offers a real-world financing model to take similar programs to scale. This project used three successful financing measures to reduce the cost and corresponding loan amount for participating *agariyas*: (1) vendor financing; (2) capital subsidies; and (3) low-cost loans

As Phase 1 (Table 1) of this pilot project, SEWA loaned the solar pumps to its members on five-year, zero-interest installment plans. SunEdison provided these pumps to SEWA at zero-cost vendor financing. To avoid burdening the farmers, the installments were seasonal, i.e. payable during the salt-production season. These loans were affordable because of the money the farmers saved on diesel, which effectively meant that the pumps paid for themselves by the end of the period. The payback period for *agariyas*, switching to hybrid pumps can be as low as 38 months, assuming a 12 percent interest rate. The interest rates on these loans are significantly lower than those offered by informal money-lenders.

Additionally, NRDC and SEWA worked with MNRE to include solar water pumps in MNRE's capital subsidy scheme, which was intended for larger capacity irrigation pumps. This further lowered the costs for the salt farmers. SEWA also helped the *agariya* women meet some of the basic eligibility criteria for financial access, such as identification documents. The salt farmers' successful repayment record demonstrated the economic viability of the solar pump financing. In the subsequent phases SEWA Bank's Grassroot Trading Network for Women (GTnFW),¹² facilitated the financing.

Thanks to the pilot's success (Phase 1), and International Finance Corporation's (IFC) assistance, mainstream commercial banks are now financing solar pumps. This has helped scale up the project. IFC created the architecture of blended financing¹³ that made credit affordable for buying solar pumps. This helped Yes Bank extend financial support in 2016-17, through interest subvention,¹⁴ for 600 solar pumps to SEWA Bank. Of these, SEWA bank has extended finance for 300 more pumps as of 2017-18.

IFC was also instrumental in designing affordable financial solutions which helped Bank of Baroda (BoB) extend loans at reasonable rates to *agariyas*. For example, loans from BoB helped install an additional 600 pumps. BoB and SEWA also have a Memorandum of Understanding where BoB will extend direct loans for 15,000 more solar pumps, enabling a massive expansion. In addition, the Government of Gujarat announced 80% subsidies on solar water pumps for salt farming in 2017.¹⁵

Table 1 Phase-wise Solar Pumps Sold in the Little Rann of Kutch

	Phase 1: 2014-15 Pilot	Phase 2: 2016-17	Phase 3.1: 2017-18	Phase 3.2: 2017-18
Number of pumps	200	200	101	599
Financing Support	- Sun Edison loan at zero-interest (vendor financing)	- SEWA Bank loan; MNRE/NABARD capital subsidies** - Interest subvention by Yes Bank - IFC support in structuring commercial finance	- SEWA Bank loan; Government of Gujarat announced capital subsidy - Interest subvention by Yes Bank - IFC support in structuring commercial finance	- Bank of Baroda loan; Government of Gujarat announced capital subsidy
Loan Tenure¹⁶	5 years	Initially 5 years, 3 years post subsidy receipt	5 years (may change once subsidy is credited)	7 years (may change post subsidy is credited)
Cost of Pump	₹205,000 (~ \$ 3,153)	₹179,150 (~ \$ 2,756)	₹185,000 (~ \$ 2,846)	₹165,000 (~ \$ 2,538)
System¹⁷	1.5 kW solar PV system and 1.5 HP motor	2.1 kW solar PV system and 2 motors of 1 HP each	3 kW solar PV system and 2 motors of 1 HP each	2.7 kW solar PV system and 2 motors of 1 HP each

* kW: kilowatt; PV: Photovoltaic; HP: Horsepower; MNRE: Ministry of New and Renewable Energy; NABARD: National Bank for Agriculture and Rural Development; SMBVM: Surendranagar Mahila Bal Vikas Mandal; IFC: International Finance Corporation

** MNRE subsidy schemes routed through solar were discontinued in 2017.¹⁸

MULTIPLE BENEFITS OF SOLAR PUMPS

This pioneering renewable energy project demonstrates that farmers can dramatically increase their annual net income by switching from diesel to solar-powered pumps. Solar pumps also demonstrated higher efficiency and reliability through these pilot projects, enabling *agariyas* to increase their harvested salt output, pursue other lucrative activities, and have better health and educational opportunities.¹⁹

The switch to solar-powered pumps also aligns with the central government's goals of 24/7 affordable energy access, increased clean energy usage, and contributes towards the National Solar Mission's off-grid solar target. Reducing reliance on imports of fossil fuels is an additional benefit of this intervention. Moreover, replacing diesel with solar power can provide significant climate and health benefits as solar energy does not emit greenhouse gases or other air polluting toxins.

Economic Impacts

Agariyas use about 1,300 liters of diesel to power their pumps over the 8-month salt farming season. With volatile diesel prices, *agariyas* spend around 40% of their annual revenue on diesel expense. Higher the diesel price, higher is the expense incurred or lower is the production (if they choose to maintain the expense level). In addition, *agariyas* need to travel long-distances to procure diesel when the supplies run out. The resultant income left after accounting for diesel and production costs is meagre, perpetuating the poverty cycle. However, using solar pumps to replace diesel use, helps bring down the expense and increase disposable income significantly.

The pilot project in 2015 offers compelling results on cost savings and financial feasibility of the project. For instance, a hybrid system based on solar PV and diesel can boost net income by 94% by avoiding the need to buy expensive fuel (Table 2). Our analysis demonstrates that the net income, typically, rose from ₹18,000 (~ \$277) per annum per pan under sole dependence on diesel to ₹35,000 (~ \$538) on hybrid use. Once the loan is paid off, their annual net income further increases to ₹80,000 (~ \$1,230) per pan using a hybrid system.²⁰ In addition, *agariyas* using the hybrid pumps with more reliable fuel supply have also seen an increase salt production per pan, allowing them to earn a higher revenue per pan.

The increases in net income have also helped some *agariyas* to purchase more solar pumps enabling them to replace diesel, almost, completely, increase production, and diversify sources of income through investment in new livelihood generation opportunities (See Box 4). This intervention also contributes to increasing female participation in the workforce and enhancing income generation and employment creation activities which are amongst the developmental goals of the Government of India.²¹

Table 2 Comparison of Costs²²

Description	Scenario 1: Diesel Engine Based Mechanical Pump	Scenario 2: Diesel + Solar PV Hybrid Electric Pump
Power Source	Diesel Engine	Solar PV by Day & Diesel Engine Generator in Night
System Cost	₹40,000 -52,000 (~ \$615 - ~\$800)	₹185,000 (~ \$2,846)
Normalized Annual Fuel Cost (A)	₹72,000 on diesel fuel (~ \$1,107)	₹40,000 on diesel fuel (~ \$615)
Normalized Annual Salt Production and average salt procurement price per pan (B)	600 Metric Tons ₹90,000 (@ ₹150/metric ton) (~ \$1,384)	800 Metric Tons ₹120,000 (@ ₹150/metric ton) (~ \$1,846)
Equated Monthly Installment for solar pump during season (C)	n/a	₹45,000 (~ \$692)
Annual Net Income per Saltpan [(B)-(A)-(C)]	₹18,000 (~ \$277)	₹35,000 (~ \$538)
Percentage Increase in Net Income	n/a	94%

*₹1 = \$65

Figures based on reported expenditure and income figures by salt farmers, and NRDC calculations

Source: SEWA-NRDC calculations 2016

Going forward, promoting the use of solar panels and pumps during off-season in other productivity activities and negotiating a better price for salt produced will help increase the *agariyas'* income further. The current rate offered by salt-traders is very low. It ranges between ₹140 – 180 per metric ton for industrial grade salt and ₹180 – ₹90 per metric ton for edible salt.²³ In contrast, edible salt retails between ₹15 to ₹30 per metric kg. Salt-traders also impose a ceiling on how much they will procure in a season. Consequently, despite an increase in production, *agariyas* sell less than their production potential. A paucity of traders operating in the area and insufficient market linkages make it difficult to procure a better price.

BOX 3: ADVANTAGES OF SOLAR WATER PUMPS

The Government of India has a target of deploying at least one million solar pumps by 2021.²⁴ As of December 2017, India has an installed capacity of around 147,000 solar water pumps and another 100,000 sanctioned.²⁵ Agricultural solar water pumps are concentrated primarily in Punjab, Rajasthan, Haryana, and Bihar. Solar pumps offer the following benefits:

- Lower and more stable fuel costs
- Zero risk of harmful spills
- Easy installation and portability, which means lower maintenance
- Zero greenhouse gas emissions

Social Impacts

SEWA's intervention in this region also provides a critical impetus to help improve education, reduce drudgery associated with using a diesel pump, and enhance women *agariyas*' involvement in income generation activities and decision-making.

Back to School

The LRK has few schools. As a result, *agariya* children miss several months of their academic year. Most *agariya* families cannot afford to enroll their children in schools with hostel facilities (*ashramshalas*)—the alternative to public schools. Consequently, the *agariya* community has poor literacy rates and is classified as a socio-economically marginalized tribe.²⁶

The direct economic benefits from solar pumps have led to an increased investment in education. For example, Gauriben Zinzaria, a long-time SEWA member from Nava Kuda village, has two solar pumps and a small flour mill. Her children now go to school more regularly as she can afford to leave them behind at home with an elderly family member during the salt producing season. Plus, she can afford to travel back home, over 5 kilometers from the Rann, more frequently. She also hopes to send her children to high schools outside the village with the rise in income because of her solar-pumps. Dozens of other women like Gauriben are using their solar pumps to create a brighter future for their children. They also act as example for other *agariyas* on the benefits of switching to solar.

Increased Efficiency = Reduced Drudgery

Typically, an *agariya* using diesel-based water pumps spends significant time and energy in procuring diesel, re-starting the generator prone to sudden stops, and staying up the night to prevent disruptions while the brine water pumps. The low grade of diesel used in pumps²⁷ and inefficient systems mean frequent break-downs or repairs, which cost money to fix. Solar-generators and better pumps eliminate virtually all these problems. The increased salt production has also reduced the need to stay up through the night.

Role in Decision-making

SEWA's work with the *agariya* women since the 1990s, has helped main-stream the role of women in income generation activities and increase their asset ownership. Financial success of the solar project, improvements in living conditions, and personal skills enhancement have given them a confidence in their entrepreneurial abilities and a larger say in household-decision-making. These have also led to a greater sense pride in their sustainable traditional skills and clean choice.





Environmental Impacts

Solar-based pumps also produce environmental benefits but cutting emissions, reducing air pollution, and is even beneficial for wildlife.

According to NRDC and SEWA analysis, if just one percent of the total *agariya* families in the Little Rann of Kutch shift from diesel water pumps to solar water pumps, it would cut up to 1,490 metric tons of carbon dioxide emission per year. That's equivalent to 3.65 million miles driven by an average passenger vehicle.²⁸ If half of the total number of *agariya* families switched to solar pumps and the other half switched to hybrid pumps, it would save a cumulative of 115,000 metric tons of CO₂. In addition, as solar energy emits no pollution, they are better for the climate and human health. These benefits also extend to the wildlife in the Little Rann of Kutch, which is located in a protected Sanctuary and Biosphere Reserve for endangered Asiatic wild ass.

Table 3 Avoiding Carbon Emissions – Replacing Diesel pumps with solar and solar/hybrid models

Description	Figures
Number of Agariya Families	43,000
Number of months of salt production	8 months
Average diesel reduction per month per farmer using solar system	162.5 liters
Average diesel reduction per month per farmer using solar/diesel hybrid system	87.5 liters
Total diesel consumption per year (only diesel for all families)	56 million liters
Average reduction in total diesel consumption per year assuming 50% families use solar pumps & 50% use solar/diesel hybrid	43 million liters
Carbon intensity of diesel	2.7 (Kg CO ₂ /l)
Annual CO ₂ emissions from <i>agariyas</i> ' diesel consumption	115,000 metric tons
Equivalent number of passenger vehicles that need to be taken off the road to achieve this level of CO2 emissions reduction	24,625 cars

Source: These figures are based on NRDC-SEWA analysis.²⁹

BOX 4: ONE AGARIYA WOMAN+ONE HYBRID PUMP=THREE SOLAR PUMPS

Bhavnapen Koli is a third-generation salt farmer and one of the first participants in the SEWA solar pilot project. Before 2013, she relied solely on a mechanical diesel pumps that required 13 barrels of diesel per season, at a cost of approximately ₹145,600 (~ \$2,240)³⁰ per season. Her annual revenue was about ₹318,750 (~ \$4,903) each year, and her annual net income after expenses totaled ₹119,250 (~ \$1,834). In 2013, she started using a hybrid diesel generator/solar PV system for one of the two pans and a diesel-powered generator for the second pan.

Reduction in costs with Hybrid

In 2013, Bhavnapen began using a hybrid of 1 kW of solar in addition to diesel. Her demand for diesel dropped to 75 liters of diesel per month per pan, the equivalent of 6 barrels of diesel per season. She spent ₹67,952 (~ \$1,033) on diesel to produce salt. That's a 54 percent reduction.

Bhavnapen paid SEWA for her hybrid system in five annual installments of ₹25,000 (~ \$384). She also upgraded from a mechanical pump to a more energy efficient diesel generator, reducing her diesel pump maintenance expenses by around 90%. Compared to a diesel only system, her total costs with a hybrid system fell by 31%, ₹63,550 (~\$977), after including annual installments and other costs.

Rise in Income with Hybrid

The solar-powered water pump yielded 945 metric tons of salt (industrial-grade) compared to about 750 metric tons from the same pan under a diesel-only system. The production of salt (edible) from the pan using diesel pump remained at 750 metric tons. At a rate of ₹240 per metric ton of edible salt and ₹185 per metric ton of industrial-grade salt, Bhavnapen made approximately ₹354,825 (~ \$5,458) in total. After accounting for costs, her net income from the two-pans, using diesel and solar/diesel hybrid, increased by 84% over only diesel use before 2013.

This rise in income has also helped her purchase more solar pumps and invest in a small flour mill. She now has 3 pumps and does not use diesel. "Thanks to solar, my son is studying in a private school" says Bhavnapen.



UNLOCKING SUSTAINABLE FINANCE

Agariyas often lack a credit history, a steady income, and collateral security. Financial institutions often require a number of official Know Your Customer documents such as land lease agreements, identity documents, and proof of residency/address to process loan applications. As a result, traditional lenders like banks see them as high-risk investments. In addition, *agariyas'* remote geographical location makes it harder for banks to service them due to limited institutional infrastructure in these areas.

There are also operational risks, including possible equipment failure during the loan period. Without reliable system warranties, any break down in the solar system can affect performance and production, thereby rendering the family unable to repay the loan. Production could also be hampered by improper maintenance or damage to portable panels in transit. Incremental repayments for high-interest loans, availed from money-lenders, may cause the borrower to sink into debt instead of rising out of poverty.

These problems are shared by a large majority of low-income, marginalized households in India who are not financially literate. However, the solar pumps project in LRK has demonstrated ways to overcome these barriers. Over the last few years, SEWA has helped a majority of salt farmer households obtain their first identification documents, a baseline step for financial inclusion. These cards needed for them to open bank accounts and apply for loans. In addition, successful demonstration of regular payback has helped attract institutional financing. Government policies are also expanding banking services to disadvantaged population across the country. Over the last five years, the government's "Pradha Mantri Jan-Dhan" policy has led to the establishment of 32.25 million new accounts in India.³¹

Innovative Finance Mechanisms

Other than loans from banks, decentralized renewable energy (DRE) projects can explore the following:

- **Blended financial solutions** can catalyze clean-energy-based livelihood solutions targeted towards the underserved population. Small DRE projects, especially those focused on marginalized communities, can solicit CSR funding. For example, in the LRK, Yes Bank extended interest subvention to SEWA Bank's primary loan which enabled them to lend to more *agariyas*. Small DRE projects, especially those impacting marginalized communities, can look for support from such blended financing measures.
- **SEWA's Financing Instruments.** SEWA Bank has designed a special "energy loan product" that includes solar appliances to improve basic living conditions, increase income and productivity, and reduce expenses. In the absence of traditional collateral, a regular savings record can be developed over the course of a year as security before an individual is eligible to apply for a loan.
- **Regional Rural & Cooperative Banks, Non-banking Financial Companies, Micro-Finance Institutions** have the potential to provide loans for off-grid and DRE projects. An established institutional guarantor could backstop the loan in case of default, making capital cheaper to lend to *agariyas* borrowing money to purchase a solar-powered water pump. For instance, National Bank for Agriculture and Rural Development (NABARD) is set up as an apex development bank by the Government of India for promoting integrated and sustainable rural development.³² NABARD has been facilitating as many as 200 cooperative banks to reach rural areas. Integrating clean energy with financial inclusion goals can be effective in scaling DRE projects across the country.
- **Pay-As-You-Go models** utilize mobile money platforms, which allow customers to pay for the energy they use in small instalments loaded onto cell phones (mobile money). This model helps consumers regulate their usage and expense. In addition, it leverages the high number of cell phone owners in India's rural villages. For example, Mera Gao Power, provides solar microgrids that can power up to 100 rural households' lightbulbs and cell phone battery recharge for seven hours for about \$0.5/month per household.³³

POWERING FORWARD

SEWA-NRDC business case on the solar project highlights financial and technical solutions to enhance traditional livelihoods. This intervention mainstreams the role of women *agariyas* in income generation and enables them to continue to produce salt in a low-carbon, sustainable, and profitable way.

The project also offers lessons for the expansion of other off-grid projects. For instance, around, in 2017, around 8 million irrigation pumps powered by diesel, and another 12 million pumps powered by heavily subsidized grid electricity were in use.³⁴ These can be economically replaced by solar-powered versions. This could boost incomes and provide environmental and health benefits, just as it did for the salt farmers. Coupling such an initiative with groundwater recharge measures, water-conserving irrigation techniques, and tailored financial solutions offers a holistic solution, and can reach a larger number of farmers.

The innovative solar salt-water pumps initiative described in this factsheet reveals remarkable economic, social, and environmental opportunities from switching from diesel to solar-powered pumps. Moreover, through targeted financial solutions, these projects could be scaled up further, providing clean energy access for a greater number of *agariya* households.



ENDNOTES

- 1 Salt Commissioner, Government of India. n.d. *Salt Industry in India*. Available at: http://saltcomindia.gov.in/industry_india.html?tp=Salt (accessed on 20 August 2018)
- 2 Sustainable Energy for All (SE4ALL). 2015. *Solar Pumps Help Indian Women Salt Workers Escape from Poverty*, January 29. Available at: https://www.seforall.org/2015_01_29_solar-pumps-help-indian-women-salt-workers-escape-poverty (accessed on 20 August, 2015).
- 3 The *agariyas* are classified as an economically and socially backward tribe. Government of Gujarat. 2015. *Human Development Report – Surendranagar*. Available at: http://www.in.undp.org/content/dam/india/docs/human-development/District%20HDRs/7.%20Surendranagar_DHDR_September%202015.pdf (accessed on 20 August, 2018)
- 4 Self Employed Women's Association (SEWA). 2009. *Sister Organizations*. Available at: http://www.sewa.org/About_Us.asp (accessed on 29 August 2018).
- 5 \$1 = ₹65 for all conversions
- 6 Ministry of New and Renewable Energy (MNRE), Government of India. 2012. *Jawaharlal Nehru National Mission. Phase II – Policy Document*, Pg. 22. Available at: <https://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf> (accessed on 30 August 2018)
- 7 REC. 2018. “24 x 7 Power for All” PROGRAM (A Joint Initiative of Central Govt. & State Governments). Available at: <http://www.recindia.nic.in/power-for-all> (accessed on 30 August 2018)
- 8 MNRE, Government of India. 2015. *Annual Report 2014-15*, Ch. 4. Available at: https://mnre.gov.in/file-manager/annual-report/2014-2015/EN/Chapter%204/chapter_4.htm (accessed on 20 August 2018)
- 9 Practica Foundation. 2010. *Salt Workers Economic Empowerment Program* (SWEEP). Available at: <http://practica.org/projects/salt-workers-economic-empowerment-program-sweep/> (accessed 20 August, 2018).
- 10 MNRE subsidies were earlier available on pumps meant for agricultural use, and not suitable for salt-farming. Salt-farming and hence *agariyas* were excluded.
- 11 Know Your Customer or “KYC” requirements
- 12 Grassroot Trading Network for Women is a green livelihood initiative delivering financial and energy products to build livelihoods of women at the bottom of the pyramid. It is promoted by SEWA.
- 13 Blended Finance – defined by Organization for Economic Co-operation and Development (OECD) as the strategic use of development finance for the mobilization of additional finance towards sustainable development in developing countries. Blended finance includes development, and donor funds – to mobilize private capital flows to target markets. These blended structures can have a substantial impact by shifting the investment risk-return profile for private investors by using flexible capital and favorable terms. OECD. 2018. *Blended Finance Principles for Unlocking Commercial Finance for the Sustainable Development Goals*. Available at: <https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/OECD-Blended-Finance-Principles.pdf> (accessed on 31 August 2018).
- 14 Interest subvention means subsidy or rebate in rate of interest (ROI).
- 15 Parikh, Niyati. 2018. Women show solar power is worth its salt. *Times of India*, March 9. Available at: <https://timesofindia.indiatimes.com/city/ahmedabad/women-show-solar-power-is-worth-its-salt/articleshow/63224681.cms> (accessed on 15 August 2018).
- 16 In most cases, loans have been paid back much sooner than the expected payback period.
- 17 A solar photovoltaic (SPV) water pumping system consists of: PV array; mounting structure with a provision of tracking the sun; motor pump set with suitable Inverter; Maximum Power Point Tracker (MPPT), with Controls / Protections; and interconnect cables and “On-Off” switch. From SEWA. 2015. *Request for Proposals of the Solar Water Pumping Systems (SWP) for SEWA*. Available at: http://www.sewa.org/pdf/SEWA-Solar_Water_Pump_RFP.pdf (accessed on 16 August 2018).
- 18 NABARD. n.d. *Solar Schemes* available at: <https://www.nabard.org/content1.aspx?id=596&catid=23&mid=> (accessed on 16 August 2018).
- 19 SE4ALL, Solar Pumps Help Indian Women Salt Workers Escape from Poverty, *supra*.
- 20 Adding “equated monthly installment during season” and “annual net income” from Table 2.
- 21 Ministry of Finance. 2018. *Budget 2018-19 Speech*. Available at: <https://www.indiabudget.gov.in/ub2018-19/bs/bs.pdf> (accessed on 31 August 2018).
- 22 The analysis is based on annual costs, earnings, and expenditure in salt farming operation as reported by farmers and demonstrates possible rise income through use of solar PV. The calculations consider the common operation of preparation of industrial grade salt. Some farmers also prepare food-grade salt, which earns a higher market price, but has stringent requirements on quality.
- 23 Edible salt is of a higher grade than industrial and fetches a better price. Reported figures from SEWA's female *agariya* members.
- 24 MNRE, Government of India. 2014. *Solar Pumping Programme for Irrigation and Drinking Water Supplementary Guidelines*. Available at: <https://mnre.gov.in/file-manager/UserFiles/Scheme-for-Solar-Pumping-Programme-for-Irrigation-and-Drinking-Water-under-Offgrid-and-Decentralised-Solar-applications.pdf> (accessed on 30 August 2018)
- 25 MNRE, Government of India. 2018. *Annual Report 2017-18*. Available at: <https://mnre.gov.in/annual-report-2017-18>

- gov.in/file-manager/annual-report/2017-2018/EN/index.html (accessed on 20 August 2018)
- 26 Government of Gujarat. 2015. *Human Development Report – Surendranagar, supra*.
 - 27 Agariyas use Light Diesel Oil (LDO), a poor-grade diesel, in diesel-based pumps.
 - 28 US EPA. 2017. *Clean Energy Resources Calculator*. Available at: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator> (accessed on 20 August 2018).
 - 29 For carbon intensity of diesel, see Intergovernmental Panel on Climate Change. 2005. *Safeguarding the Ozone and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons (SROC)*. *Special Report, Table 3.5*. Available at: <https://www.ipcc.ch/pdf/special-reports/sroc/Tables/t0305.pdf> (accessed on 20 August 2018) For carbon emissions' car equivalency number, see US EPA. 2017. *Clean Energy Resources Calculator*, <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator> (accessed on 20 August 2018).
 - 30 \$1 = ₹65 for these calculations
 - 31 As of 1st August 2018. Ministry of Finance, Government of India. *Pradhan Mantri Jan- Dhan Yojana*. <https://www.pmjdy.gov.in/account> (accessed on 8 August 2018).
 - 32 NABARD has a mandate for facilitating credit flow for promotion and development of agriculture, small-scale industries, cottage and village industries, handicrafts and other rural crafts.
 - 33 Singh, Seema. 2012. *Solar Microgrids*. *MIT Technology Review*, April 25. Available at: <http://www2.technologyreview.com/news/427670/solar-microgrids/> (accessed on 31 August 2018).
 - 34 Bloomberg New Energy Finance (BNEF). 2017. *Accelerating India's Clean Energy Transition*. Available at: https://data.bloomberglp.com/bnef/sites/14/2017/11/BNEF_Accelerating-Indias-Clean-Energy-Transition_Nov-2017.pdf (accessed on 31 August 2018).



Accelerating Clean Energy for All in India, Sameer Kwatra<https://www.nrdc.org/experts/sameer-kwatra/accelerating-clean-energy-all-india>**Unlocking Finance to Achieve India's Clean Energy Goals, Nehmat Kaur, Anjali Jaiswal**<https://www.nrdc.org/experts/nehmat-kaur/unlocking-finance-achieve-indias-climate-energy-goals>**Solar Energy Brings A Ray of Hope to Salt Farmers in Gujarat, Frances Beinecke**<https://www.nrdc.org/experts/frances-beinecke/solar-energy-brings-ray-hope-salt-farmers-gujarat>**Out of the Darkness and into the Light, Sasha Stashwick, Kaitlin Brazill**<https://www.nrdc.org/experts/sasha-stashwick/out-darkness-and-light>**Worth Their Salt: How Clean Energy is Powering a Breakthrough Opportunity for Saltpan Farmers in Gujarat's Desert - Part 3, Sameer Kwatra**<https://www.nrdc.org/experts/sameer-kwatra/worth-their-salt-how-clean-energy-powering-breakthrough-opportunity-saltpan>**Worth Their Salt: How Clean Energy is Powering a Breakthrough Opportunity for Saltpan Farmers in Gujarat's Desert - Part 2, Sameer Kwatra**<https://www.nrdc.org/experts/sameer-kwatra/worth-their-salt-how-clean-energy-powering-breakthrough-opportunity-saltpan-0>**Worth their Salt: How Clean Energy is Powering a Breakthrough Opportunity for Saltpan Farmers in Gujarat's Desert - Part 1, Anjali Jaiswal**<https://www.nrdc.org/experts/anjali-jaiswal/worth-their-salt-how-clean-energy-powering-breakthrough-opportunity-saltpan>**Will India's First Renewable Energy Financing Summit Deliver Solutions to Improve the Livelihoods of India's Rural Salt-Pan Farmers?, Anjali Jaiswal**<https://www.nrdc.org/experts/anjali-jaiswal/will-indias-first-renewable-energy-financing-summit-deliver-solutions-improve>

Self Employed Women's Association (SEWA) is a member-based organization of poor, self-employed women workers in India. SEWA is spread across 14 states of India with deep penetration at grassroot level in villages. SEWA also works in Afghanistan, Nepal, Sri Lanka, and Myanmar. SEWA has membership reach of 1.7 Million globally. SEWA organizes the women into self-help groups and cooperatives based on their respective trades and then channelizes information, awareness, health interventions, trainings for skill development, financial support (e.g. savings, insurance, credit, and pension), and market linkages to enable members to become self-sustainable in their trades, including salt production. SEWA's twin goals are "Full Employment" and "Self-Reliance". "Full employment" includes work security, income security, food security and social security (at least healthcare, childcare, nutrition, shelter) whereas "self-reliance" means making members autonomous economically and in decision-making. For more information, visit www.sewa.org.

Natural Resources Defense Council (NRDC) is an international non-profit environmental organization with more than 1.4 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC's India Initiative on Climate Change and Clean Energy, launched in 2009, works with partners in India to help build a low-carbon, sustainable economy. For more information, visit www.nrdc.org.

Supported in part by



Copyright © 2018 Natural Resources Defense Council

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission.