COMET-ME 2017 ANNUAL REPORT

COMMUNITY
ENERGY
TECHNOLOGY
IN THE MIDDLE EAST

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EXECUTIVE SUMMARY

2017 has been the biggest year of operations for Comet-ME since its foundation. Through two major installation drives, carried out in parallel in two different geographical regions, we have brought reliable access to electricity to 235 families and clean-water services to 71 households throughout Area C of the occupied Palestinian territories. With our maintenance and monitoring programs, reaching 55 communities and nearly 5,000 beneficiaries to date, we have ensured the longevity of our systems and the sustainability of the services we provide. In our research and development program, we have developed a new custom-designed data-logging system for our mini-grid installations and continued developing our stand-alone solar pump targeting smallholder farmers in the Global South.

A major unforeseen challenge this past year was the seizure by the Israeli Civil Administration of a large mini-grid in the Bethlehem-area village of Jib a-Dhib on June 28, 2017. This violent act by the authorities left the village and its 160 inhabitants without power after having experienced eight months of reliable 24/7 electricity thanks to a Comet-ME mini-grid. After a concerted legal and diplomatic campaign, we successfully retrieved and reinstalled the system and restored power to the village at the beginning of October 2017.

Photo Ryan Brand

ABOUT US

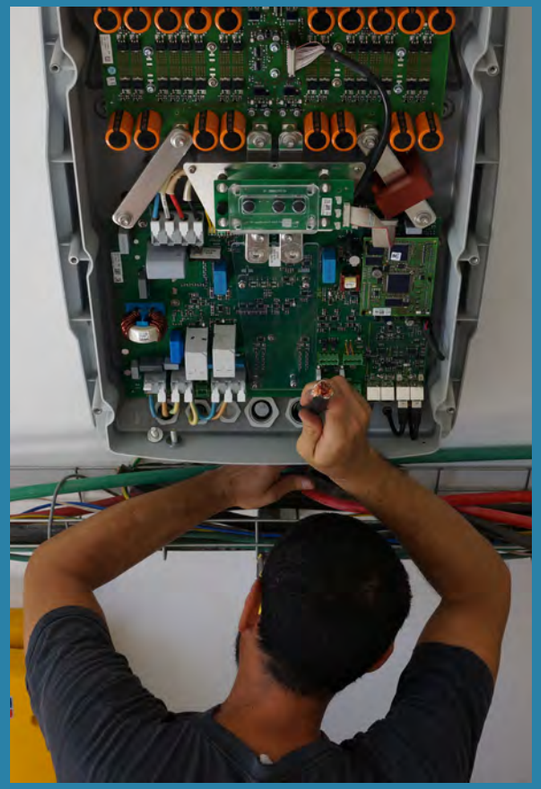

Photo Ryan Brand

WHO WE ARE

Comet-ME is an Israeli-Palestinian organization providing basic energy and clean-water services to off-grid communities using environmentally and socially sustainable methods. We facilitate the social and economic empowerment of some of the poorest and most marginalized communities in the occupied Palestinian territories through the installation of renewable wind and solar energy systems, provision of clean water services, capacity building, and reliable maintenance.

Our work has developed out of a long-standing relationship and commitment to the marginalized Palestinian communities in Area C—from our base in the south Hebron hills, throughout the southern West Bank, and into the Jerusalem-Jericho corridor. Initially a voluntary initiative, Comet-ME carried out its first installations in 2006 and formally incorporated in Israel as a public benefit company in September 2009. Today, we are a vertically integrated utility, providing basic energy services to 55 communities encompassing nearly 5,000 people. In 2013 we entered the field of off-grid water pumping and filtration solutions, and since then have brought our clean-water services to over 200 households throughout our energy install base.

Since the establishment of our Center for Appropriate Technologies in the south Hebron hills in 2012, Comet-ME has been a daily presence in the lives of the beneficiary communities, responding to any issue—technical or social—that arises, and in this way establishing ourselves as a reliable and trustworthy service provider in the region.

Comet-ME is currently the leading provider of sustainable rural electrification services in the region, and an innovator in the field of off-grid water technologies.

Photo Ryan Brand

THE TEAM

Founders and directors
Elad Orian, General Manager
Noam Dotan, Technical Manager

Energy Project Manager
Ahmad Almasry

Maintenance Manager
Waseem Alja'bari

Water Project Manager
Abd Qabajah
Moatasem Hadalin

Design Engineer
Ryan Brand

Technicians
Muhammad Aqeel
Musab Shrouf
Ibrahim Mhamara
Dahham Abu Aram
Khalil Shehadah Abu Sabha

Water Expert
Ahmad Sayareh

Community Outreach Coordinator
Muhanad Kharraz
Asmahan Simry

Organizational Development Manager
Tamar Cohen

Financial Manager
Basheer Abu Baker, CPA

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Dr. Yoav Lehahn

WHERE WE WORK

Comet-ME's work targets rural off-grid farming and herding communities in Area C of the occupied Palestinian territories. These are mostly arid regions, whose inhabitants subsist on non-mechanized agriculture and herding. The harsh climate is compounded by an extremely difficult political reality by which the communities live disconnected from all infrastructure, including access roads, electricity, and running water.

Area C constitutes 62% of the West Bank and is under full Israeli military and civil control, including all matters pertaining to planning, construction, and development. Area C is the only remaining land and agricultural reserves for a viable future Palestinian state and economy, but most of the land has been allocated for the benefit of Israeli settlements of the Israeli military. The discriminatory planning regime imposed by Israel, harassment and violence by settlers, and restrictions placed by the military, are tantamount to a policy of *de-development* for the protected Palestinian population, aimed at pushing them out of Area C to make way for Israeli development and settlement expansion.

In Area C, rural Palestinian villages' distance from the grid is thus not geographical but political—with electricity and water lines running literally meters above their heads and below their feet to connect nearby illegal Israeli settlements and outposts. The lack of regular access to electricity means that the communities do not have access to the most basic amenities such as refrigeration (of food, water, and medication), lighting, and telecommunications. Families must make several trips a week to nearby towns to charge cell phones, receive medication, and purchase food, in particular in the hot summer months. Without access to appliances such as butter churns, washing machines, and mechanical water pumps, the women in these communities spend hours a day at the tasks of producing dairy products, doing laundry, and carrying water from cisterns to the homes. The hours spent at manual labor mean less hours spent with their children, helping with homework, or simply engaging in leisure activities, before and after dark.

Over Comet-ME's nearly a decade of experience in the field, we have seen how the provision of basic energy services to marginalized communities in Area C has proven to be an effective means for community empowerment and economic development.

Comet-ME has been designing, installing, and maintaining renewable energy systems for vulnerable Palestinian communities in Area C since 2009. From 2009 until the end of 2014 we worked exclusively in the Yatta district of the south Hebron hills. In the past three years we have expanded the geographical scope of our work beyond the south Hebron hills westward and northward into the Samu' and Dhahariya districts, the northern parts of the Hebron district, the Bethlehem district, and the Palestinian-Bedouin communities in the Jerusalem-Jericho Corridor. Pictured here: A Comet-ME family-based solar energy system in a Palestinian Bedouin community in the Jerusalem-Jericho corridor (the so-called E1 area and environs), with the settlement of Ma'aleh Adumim in the background.

Photo Jimmy Granger

HOW WE WORK

Comet-ME is a unique hybrid of technological start-up, development aid agency, and political grassroots human rights organization, while functioning in the day-to-day as a mini-utility for off-grid Palestinian communities in Area C. Comet-ME's integrated Palestinian and Israeli team combines technological and technical expertise with project-management, organizational, financial, and community-outreach skills. Our work is based on the following principles:

RENEWABLE ENERGY

The leader in rural electrification in the occupied Palestinian territories, Comet-ME designs, installs, and maintains renewable energy systems (wind and solar) that provide electricity 24/7, 365 days a year. Our renewable energy systems range in size from single-family systems to community-scale micro-grids, designed according to the needs and situation of each community. All of our energy installations provide the same basic electricity services for each household: 2-3 kWh/day – enough for illumination, refrigeration (of food and medicine), cell-phone charging, television, radio, and computeres, and use of basic appliances, in particular washing machines and butter churns.

APPROPRIATE TECHNOLOGIES

We espouse a dynamic, needs-driven approach to our technological solutions, based on a uniquely short cycle of needs assessment, technological development, piloting, wide-scale implementation, and user feedback. The technological developments and applications developed over the past decade include the design of hybrid wind and solar systems that take advantage of the unique climate of the south Hebron hills; demand-side management in our energy systems and custom-designed Comet-MEters; online diagnostics that allow us to monitor and identify problems as they arise; a custom-designed smart controller, which channels surplus energy from the renewable energy systems to automatically power the water pumps in Comet-ME's household water systems; a PVC bio-sand filter adapted from an open-source design by CAWST and manufactured locally.

OPEN SOURCE

All technological details of our systems are available in the public domain. Our partnership strategy extends to a global network of practitioners. Sharing our experience with and benefiting from that of global partners, Comet-ME is part of a uniquely short loop of technology development and implementation. Lessons learned in the south Hebron hills can serve communities in Africa; developments made in student labs in the US can find their way to the field within weeks.

Comet-ME's Center for Appropriate Technologies in the south Hebron hills, inaugurated in December 2012, is the only Palestinian-Israeli technological center with expertise in renewable energy and sustainable development in Palestine. Located in a renovated structure in one of the communities in our install base, the Center is designed based on ecological and sustainable principles and runs exclusively on green energy and self-collected rainwater. The Center serves as our regional base of operations for maintenance and installations activities, R&D for new rural development technologies, workshop and warehouse, training center for staff, community supervisors, and guests, and a place for meetings and collaborations with other NGOs working in the region.

Photo Comet-ME

LOCAL SOURCING

Comet-ME procures inputs from local suppliers whenever possible. We purchase components for installation and maintenance from suppliers in Yatta, Hebron, and Ramallah and contract local workshops to manufacture some of the custom-designed components of our systems. By investing in local West Bank tech infrastructure we help develop local knowledge and practice in the field of renewable energy.

SUSTAINABILITY AND SERVICE

Functioning as a mini-utility company for off-grid communities in Area C, Comet-ME ensures the sustainability of all of its past installations through reliable maintenance and management of systems. Our center of operations is located in the heart of the communities we serve so we are available to respond to any issue that arises in a timely and effective manner.

COMMUNITY

Community participation and trust-building are integral part to our approach. We invest in building a direct and long-term relationship with the community members, whom we consider both beneficiaries and partners. Our work model is based on substantial and meaningful community participation, ownership, training, and capacity-building at every stage of the process. Our team of Palestinian and Israeli engineers, project managers, and technicians trains local community members in basic maintenance and diagnostics, helping to develop a local knowledge base that serves as a source for future development.

BUY-IN PHILOSOPHY

Beneficiaries pay an electricity bill based on metered use according to the same tariff as paid by grid-connected users in Palestine and Israel. Electricity-bill payment creates a sense of ownership, rationalizes use of energy, and contributes to maintenance costs for the systems and to the eventual replacement of major components of the systems. Beneficiaries also make a contribution of about 7% of the cost of their water systems and 1/3 of the cost of the energy-efficient refrigerators that Comet-ME subsidizes as part of our energy installations.

Virtually all of the components for our energy and water systems are procured from local Palestinian suppliers. Because our systems our custom designed, many components, such as the electricity cabinets, aluminum mounts, for both the solar panel arrays and water tanks, and PVC bio-sand filters, are manufactured by Palestinian workshops and factories in Hebron, Bethlehem, and Ramallah. Pictured here: the team unloading aluminum mounts for our water systems, produced by a local Hebron supplier.

Photo Ryan Brand

TOTAL INSTALL BASE

55 communities

5,000 beneficiaries

8 schools

22 solar and hybrid solar/wind micro-grids

400 family-based solar systems

210 household water systems

THE YEAR IN NUMBERS

In 2017 the Comet-ME team completed its most ambitious installation to date, conducting two large installation drives, one in Masafer Yatta and the other in the Jerusalem-Jericho corridor. We provided a total of 235 family-based solar energy systems in 14 communities and 71 household water systems in 9 communities, bringing our renewable-energy services to about 1,400 individuals and our clean-water services to about 400 individuals. We helped support community life and education by connecting 1 school, 1 clinic, and 1 mosque.

Photo Ryan Brand










PROFILES

Introduction

With a work methodology focused on social as much as technological or environmental sustainability, Comet-ME takes the notion of community engagement very seriously. The installation of an energy or water system is just the beginning of a long-term relationship with the communities, households, and individuals. With our earliest installations going back to 2008, we have been involved in the communities on a day-to-day basis since then—maintaining the systems, connecting new households when grown children get married, upgrading systems to meet the growing needs of developing communities, adding our clean-water systems and water-quality monitoring services, building the capacity of community members, and accompanying many of the communities in ongoing legal campaigns to protect their systems from demolition.

Over nearly a decade of empowering and supporting the *sumud* of vulnerable Area C communities through the provision of basic services, we have gotten to know hundreds of individuals and heard as many stories—stories that are both personal and unique as well as emblematic and reflective of the larger reality for all communities in Area C. We are pleased in this report to cast a spotlight on just a few of these individuals, in what we hope will be the beginning of an ongoing project.

This year we have chosen three people from three of Comet-ME's veteran communities in the south Hebron hills—Wadi Jheish, Tuba, and Sha'eb al-Buttum. We would like to thank Hajj Khalil, 'Ali Rashed, and Hajji Nuzha, for their willingness to take part in the project.

Shaeb al-Buttum, south Hebron hills, January 2018. One of the most satisfying aspects of our work over the years has been to see kids grow up and be able to take electricity (almost) for granted.

Photo Ryan Brand

Hajj Khalil Nawaja'ah, Wadi Jheish

We meet Hajj Khalil Nawaja'ah, 72 years old, and his wife, Hajji Tamam, 69 years old, on a beautiful winter day. Hajj Khalil and Hajji Tamam have 12 adult children—7 sons and 5 daughters, all of them married. One of their sons died. Three of their sons live alongside them with their families in Wadi Jheish, and today the community numbers 6 households and about 60 people. Hajj Khalil and Hajji Tamam have a small herd of about 20 sheep. Hajji Tamam prepares yogurt and butter for their own use.

Since when have you lived here, in this location?

Before '48 we lived in al-Qaryatayn [just a few kilometers from Wadi Jheish, on what became the Green Line]. In '48 we had to leave there, and we settled in Susya. In 1967 we were expelled from Susya because the Israelis said we were sitting on an archeological site. After that we went to Yatta, and in 1985 we moved to Wadi Jheish, because our land is here. This is my parents' land.

Life was easier and simpler then, there were no restrictions. We were married in 1964, when we still lived in Susya. I worked as a laborer in Aqaba [Jordan]. I would work there for about 40 days at a time and then return home to Susya.

One of the biggest difficulties Hajj Khalil and his family face is harassment from nearby Jewish settlers. The other major issue is the threat of home demolitions.

In 1995 the settlers started coming to the area with their herds. They would let them graze on our agricultural land. They would ruin everything that we had planted, which led to confrontations. In 2008, I think it was, four masked settlers came, they beat my wife and me. She was taken to Soroka Hospital [in Israel] and was in a coma for four days. To this day she has a scar on her face from this incident. I was hit on the head and had to be treated at 'Aliya Hospital in Hebron.

The first demolition happened in 1990, the Israeli Civil Administration came and destroyed one of our caves. In 2012 there was another demolition, and in August 2016, during the month of Ramadan, the ICA came and destroyed another house. Another fear I have is that our simple homes will be destroyed and blown away by the winter storms.

The ruins of a home, the one demolished by the ICA during Ramadan a year and a half earlier, are strewn like an open wound less than 100 meters from where we sit.

What is one good thing that has happened in the past 10 years?

The best thing that has happened to us in the past 10 years is the electricity. Life became easier, especially for the women in all their household work—doing laundry, making the dairy products, carrying water... Even the sheep have gotten used to the electricity. When the lights go out, they start making noises!"

Of all the places you've lived in your life, which do you like the best?

Of all the places, Wadi Jheish is the best and most comfortable, despite the settlers who harm us and limit our movement and security. In Yatta there is no quiet, there are no open spaces, everything is crowded. When you are on your own land with your own property, you feel good."

Community Wadi Jheish

Population 6 families, 60 people

Installation year 2010, upgrade in 2013

Comet-ME systems hybrid micro-grid (1 turbine, 8 solar panels), 2 H2O systems

Photo Ryan Brand

Ali Rashed Ibrahim Awad, Tuba

Ali, 20 years old, was born in Tuba. He is an English literature student at the Open University in Yatta.

How old were you when the electricity came to Tuba?

I was in sixth grade when Tuba first got electricity. I remember I used to study by candlelight or by kerosene lamp. I had to hold the lamp really close to me so that I could read and write. If there was no kerosene, the lamp didn't light, and if the lamp didn't light, you couldn't study. Children used to be stressed, they had to study and do their homework right when they got home from school, but today they can study in the evening or whenever they want. [...] The most basic things like cell-phones and computers... In the past, we would have to charge our cell phones using the tractor. You had to wait on line. Today, everyone has electricity in their home and they can charge their cell-phone and computers whenever they want.

Since 2004, by order of the Israeli parliament, the children of Tuba have walked to and from their school in nearby a-Tuwani with a military escort.

Can you tell us about the experience of walking to school accompanied by soldiers and activists?

When the settlers from [the illegal outpost] Havat Ma'on came to the area [in 1999] they took over the forest between Tuba and a-Tuwani. They attacked the Palestinians in the area, preventing people from accessing their lands and attacking children on the way to school. Between 2000 and 2003 the children had to walk a long and difficult 8-kilometer route around the forest, so that they wouldn't run into the settlers along the way. Following pressure from local and international organizations, at the beginning of the school year in 2004, the army began to accompany the children to and from school. [international activists are there every day to monitor whether the soldiers arrive, and on time, which they often don't. – Comet-ME].

How do you think the younger children experience this reality today?

The younger kids were born into this reality. It's the only thing they know. I think they experience it as a natural part of the day to day, so much so that if you ask them they don't even mention the soldiers or complain about the fact that they can't walk to school freely or without restrictions. They do talk about the attacks by the settlers, though. Before we graduated my friend Ahmad and I were the oldest kids. We would look out for them. Now that we've graduated, there are a few high-school girls who are responsible for the younger kids.

What did you like most as a student in school?

My favorite subject in school was English literature. My English teacher from 9th through 12th grade was like a friend, looking out for me and supporting me. It's largely thanks to him that I did well in school and went on to academic studies in the university. When I finish I'd like to do any job where I can use my English, like teaching or translation. I'd like to go on and do a master's degree.

Why English?

Ever since I was in the 5th grade I knew I wanted to study English. I've had contact with international activists and organizations since I was very young. I could see how important it was to be able to convey our experience, our suffering under the occupation, to the whole world in a language that people around the world will understand.

Community Tuba

Population 8 households, 76 people

Installation year 2010, upgrade in 2015

Comet-ME systems hybrid micro-grid (1 wind turbine, 9 panel solar array), 3 H2O systems

Photo Ryan Brand

Hajji Nuzha al-Najjar, Sha'eb al-Buttum

Nuzha Jibra'il Abd al-Rahman al-Najjar was born in Sha'eb al-Buttum in 1959. She is widowed and the matriarch of a large family. Of her eight children (four sons and four daughters) two sons and their families live alongside her in Sha'eb al-Buttum.

Tell us about life for your family before 1967

My family is originally from the area of Arad/al-Mirkez. Back then the entire area between Arad and Yatta was called Masafer Yatta [the rural periphery of the town of Yatta] and people could move about freely. After the Nakba, al-Mirkez was divided and my family could no longer reach the part beyond the border. For more than 100 years people moved seasonally between al-Mirkez and Sha'eb al-Buttum and they continued to do so after 1948. I was born here in Sha'eb al-Buttum, in a cave. And I have lived in the same home for the past 30 or 35 years.

How did things change in 1967?

The occupation was like a bad dream. In the '70s and '80s settlers and solders would come to the area and confiscate our herds. They would take them to Jericho for two or three days and arrest the shepherds. We would have to pay a fine to get the sheep back and free the men.

My husband and I were married in August 1973, in Yatta. The wedding lasted for 20 days and my dowry included 100 dinar, 20 gold [Ottoman] coins, a gold necklace, earrings and a ring, and clothing worth 10 dinar. While the children were growing up, my husband tended to the herd and I was home taking care of the children and the housework along with my sister-in-law.

My husband was murdered by settlers in 2001. He was driving to work with some other men. When they reached the Bani Na'im junction a settler came and shot the people in the car. He was in a coma for three years before he died. My oldest son Muhammad was 30 at the time, and the youngest daughter was 10. Life became very difficult after that; I had to take care of everything.

Hajji Nuzha's son, Jamal joins the conversation. Jamal, 32 years old, has three sons and two daughters.

How has life changed in the last ten years?

Jamal: A lot has changed in the last ten years. I was 25 when the electricity came. I remember before that all we had was a battery-operated radio. The electricity has brought development and growth in the community. First came the electricity, then the water systems, an access road, and the school that was built 4 years ago [the first two are Comet-ME projects and the last two were implemented by other NGOs; the school has about 45 students, boys and girls, from 1st through 7th grade].

Nuzha: The electricity is a precious gift. In the past, we had to do everything by hand, like laundry and making yogurt. But the electricity has helped us develop our lives and has had a very positive impact. In the past we had to draw water by hand. Today we have the pumps and it makes things much easier. The children can study at any hour that they want, including the evening. They use computers, watch television.

Jamal: I guess you could say that today there is more development but also less security.

Community Sha'eb al-Buttum

Population 29 households, about 250 people, elementary school

Installation year 2011

Comet-ME systems hybrid micro-grid
(2 wind turbines, 39 panel solar array), 23 H2O systems

Photo Ryan Brand

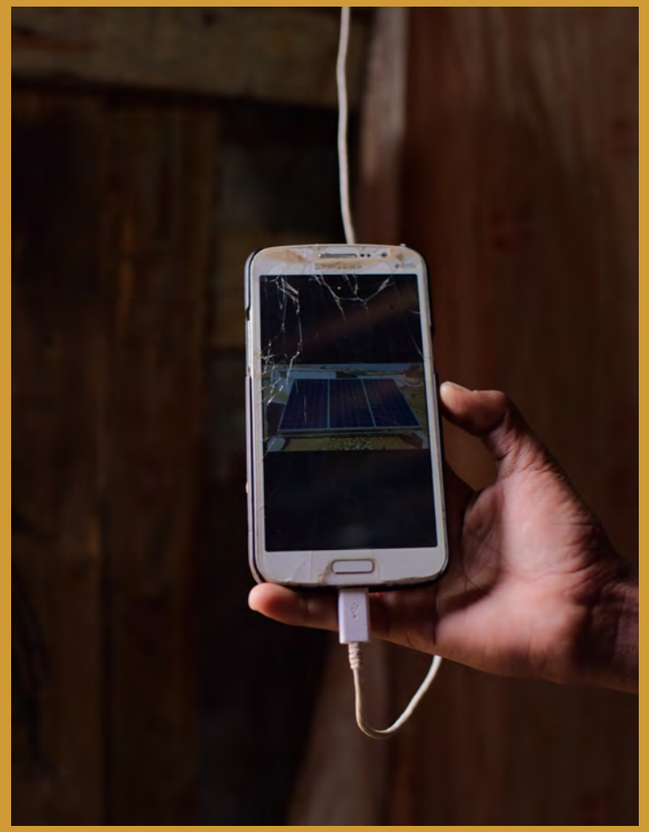

Photo Jimmy Granger

2017
ACTIVITIES REVIEW

ENERGY PROGRAM

Lack of reliable access to electricity is a major hindrance to development in Area C and makes day-to-day survival a difficult task. Lack of refrigeration, be it of food, water, or medication, particularly in the hot summer months, requires frequent trips by car or by foot to the nearest town to buy food and receive medication. Basic activities such as doing laundry, finishing homework after dark, and even cell-phone charging, cannot be taken for granted. Moreover, the production of dairy products, which is a major backbone of the local economy, requires hours of manual labor, in particular on the part of the women. Those who have partial access to electricity via diesel generators, can spend hundreds of shekels a month for just a few hours a day of electricity, and suffer from air and noise pollution next to their homes.

The implementation of Comet-ME's off-grid energy solutions in the communities over the past nearly a decade has had manifold humanitarian, economic, and social benefits. Those who experience the change in the most palpable and meaningful way are the women, who traditionally bear the brunt of the manual labor involved in the day-to-day tasks of maintaining the household and its economy—from carrying water, cleaning, cooking, and doing the laundry, to milking and producing dairy products for family consumption and sale.

The core activities of the energy program are the installation of renewable energy systems and regular monitoring and maintenance of all systems.

ENERGY INSTALLATIONS

Comet-ME's renewable energy systems provide 2.5 kWh of energy per day per household, delivering electricity for basic illumination, refrigeration, operation of simple washing machines and butter churns, cell-phone charging, television, and water pumping.

In 2017, we conducted two parallel installation drives, installing 235 family-based solar energy systems in 14 communities in two geographical areas—Masafer Yatta in the south Hebron hills, and in the Palestinian-Bedouin communities in the Jerusalem-Jericho corridor.

Above: Comet-ME's energy project manager conducting a training session on a family-based solar system. Each household selects a family member to be in charge of basic troubleshooting for their system and to be the point person with Comet-ME's maintenance team. With 400 family-based systems installed to date, often in extremely remote locations, this connection is crucial. We often succeed in solving technical issues over the phone with users, bringing the electricity back immediately and saving a trip to the field. On opposite page: installing the solar panel array for a family-based solar energy system.

Photos Jimmy Granger

MAINTENANCE PROGRAM

Comet-ME's maintenance and management program is an integral part of our sustainability approach. Through seasonal preventative maintenance, online remote diagnostics, regular community visits, and contact with community and household representatives, we are able to identify technical and social issues within hours or days and can respond in a timely manner. This helps us ensure the ongoing functioning of all of our systems and the long-term impact of our services.

Implementation of new vending scheme

Electricity-bill payment is a key component of Comet-ME's maintenance program. Upon installation, each household receives a custom-designed electricity meter and begins paying an electricity bill according to the same tariff as paid by grid-connected users in Palestine and Israel. While payments are relatively low (at 2.5 kWh/day, average monthly payments are about 40 ILS/10 USD), bill payment is essential for rationalizing energy use and creating a sense of ownership and responsibility for the users. Moreover, bill-collection records help us monitor usage patterns as well as the growth and development of the communities so that we can adjust our program to serve their growing and changing needs.

In order to keep up with the growth in our install base over the past two years (doubling our install base with a total of 360 new households in 2016 and 2017 alone) and the expansion of the geographical scope of our work well beyond our base in the south Hebron hills, this year we introduced a new vending scheme for the pre-paid electricity meter cards, transferring more responsibility to the users and to the communities.

The team repairs a wind turbine in Qawawis, south Hebron hills. As part of our maintenance program we conduct seasonal preventative maintenance on all of our turbines.

Photo Ryan Brand

One of 13 vending points across the south of the West Bank where households go to refill their prepaid electricity cards. Billed according to the same tariff as grid-connected users in Palestine and Israel, users pay a bi-monthly electricity bill of about $20 for 24/7 service.

Photo Waseem Al-Ja'bari

COMET-H2O: WATER PROGRAM

Access to water is one of the most acute issues facing impoverished off-grid rural communities in Area C. This is manifested, among other things, in insufficient water supply, inadequate delivery means, and poor water quality. The communities residing in the south Hebron hills, where Comet-ME has worked for the past decade, rely on rainwater harvesting and cistern storage for water supply, as do most Palestinian communities in Area C. Neither connected to the water grid nor permitted to build new or access many existing cisterns for rainwater harvesting, families often exhaust their water supply early in the summer and need to purchase water in tanks and transport it to their dwellings, the price they pay reaching 8 to 10 times the tariff for grid-connected users.

Rain runoff into the cisterns is contaminated with organic waste, impacting the quality of drinking water and the state of health in these communities, especially among children, the sick, and the elderly. And finally, because cisterns are not equipped with mechanized pumping capacity (due to the more general lack of electricity), water is drawn and carried manually, the burden of obtaining water for domestic use falling disproportionately on women and girls. The lack of proper delivery means increases the risk of water-borne diseases, endangering community health.

Comet-ME has developed and implemented its water program since 2013, building on our extensive experience in the renewable energy sector. The goal of the program is to provide comprehensive renewable-energy-based water services for communities struggling to survive in harsh climatic and political conditions. The core activities of the program are the installation of household pumping, storage, distribution, and filtration systems and regular monitoring of water quality. In 2017, we installed 71 water systems, bringing our total water install base to 210 households and 6 schools, serving about 3,000 people.

Clockwise from top left on opposite page: Installing the pumps on top of the cistern; lifting the 2 cubic meter tank onto the tank mount; installing the physical filters; a brand-new meter ready to track consumption; pipes leading into the home; installing a tap inside the home.

Photos Ryan Brand

WATER-QUALITY MONITORING

The bio-sand filter is the end-point of Comet-ME's household water systems, which provides clean drinking water for human consumption. The bio-sand filter is an adaptation of the traditional slow-sand filter, which has been used for community drinking water treatment for 200 years. The PVC filter container is filled with layers of specially prepared sand and gravel, which remove pathogens and suspended solids from contaminated drinking water. A biological community of bacteria and other micro-organisms grows in the top 2 cm of sand. The micro-organisms in this "biolayer" eat many of the pathogens in the water, improving the water treatment. (source: www.cawst.org/services/ topics/ biosand-filter/more-information).

Following installation of the water systems, the owners/users of the household water systems come under Comet-ME's water-quality monitoring scheme. Comet-ME's water lab technician visits the communities on a rotating basis, reaching each community every 4-6 weeks and taking samples from the bio-sand filters. The water samples are then tested in Comet-ME's in-house microbiology lab, and a weekly internal report is produced, comparing the latest results with previous results in each household. This enables us to observe the adjustment of the bio-sand filters to changes in water quality input (such as following rainfall) and to determine whether localized treatment of the water is necessary. By the end of Comet-ME's 2017 installations, our water monitoring program has reached over 200 households throughout the south Hebron hills.

In 2017, 381 tests for thermo-tolerant fecal coliforms were performed in 14 communities. Overall, 78% of results were acceptable (< 10 CFU/100 ml) while 22% of results were unacceptable (10-100 CFU/100 ml) according to Comet-ME's water-monitoring quality standards. Unacceptable results were treated locally with chlorine tablets while allowing the bio-sand filters to adjust to changes in water quality. Comparing results from the communities in which we worked in both 2016 and 2017, we found an average of 10% improvement in results of each community. Pictured here: Comet-ME's mobile water sampling kit.

Photo Tamar Cohen

The starting point of Comet-ME's household water systems is the cistern, where families traditionally harvest rainwater for human and herd consumption. The end point of the system, following pumping, physical filtration, storage, and distribution to taps, is the bio-sand filter. The bio-sand filter is placed in the kitchen and provides clean drinking water for human consumption.

Photos Ryan Brand

RESEARCH AND DEVELOPMENT

As an organization that is both highly technological and field-based, we are in a unique position that allows us to integrate real needs with technology's promising possibilities. Our goal is to bridge this gap by developing appropriate technologies that are suitable to the capacities, resources, and needs of off-grid communities in developing areas.

Custom data logging system

Throughout 2017 we have worked to develop and pilot a custom-designed data-logging system for our micro-grid installations. The system is a low-cost and easily deployable remote monitoring system for uploading data from Comet-ME's micro-grids to our server and presenting the data online. The open source system serves as an extremely important diagnostic tool for early detection of problems in the operation and general monitoring of the micro-grids. To date, two such systems are fully operational [See links to the systems in Tuba and at the Comet-ME Center] and in the coming few months, we will deploy 10 more such systems.

Off-grid pumping technologies: The Solar Magnetic Piston Pump (SMPP)

For the past four years, a major focus of our R&D work has been in the realm of off-grid water pumping solutions. Over the past year we have made great progress in the technical development of our Solar Magnetic Piston Pump (SMPP), a simple, reliable, and low-cost solar-powered water pump targeting the poorest off grid rural farmers and communities in the Global South. We have refined the mechanical design and packaging of the pump and reached our target technical specifications:

- Pumping at least 15 cubic meters/day @ 30m pump head from 4" bore hole
- Up to 600 Wp solar array
- Highly efficient and reliable single moving part
- Simple low-cost field serviceability with no special tooling

We presently have models of the pump, including all the system components, up and running in a test rig at the Comet-ME Center for Appropriate Technologies. We have begun intensive life-cycle evaluation of the pump and prepared a production file for small-scale production of the SMPP. We are currently seeking partnerships in both the non-profit sector for on-site pilot testing, and in the commercial sector to commercialize the pump and bring it to large-scale production to be able to distribute it for the benefit of the population in the developing world and other rural off-grid farmers.

Pictured on opposite page: Comet-ME's state-of-the-art testing grounds in the south Hebron hills, where life-cycle evaluation of the Solar Magnetic Piston Pump is ongoing. Our experience as a grassroots field-based organization gives our R&D insights added value beyond the technological.

Photos Ryan Brand

LEGAL PROTECTION

Lack of permitting and the threat of demolition are the most significant obstacles to rural development in the West Bank, including rural electrification and water projects such as Comet-ME's. Although couched in bureaucratic planning terminology, demolition orders and lack of permitting in Area C of the West Bank are in fact a direct result of the Israeli political agenda. The Israeli authorities hinder development projects as part of a larger policy aimed at pressuring rural communities in Area C to relocate into Palestinian urban centers in areas A and B, thus securing Israeli demographic dominance in the only remaining land reserves of the West Bank. Palestinians in Area C are subject to Israeli military rule, which is separate from the legal system that applies within Israel proper. They do not possess political and civil rights in the legal system that is imposed upon them.

Comet-ME has been fighting the threat of demolition to its systems by the Israeli authorities since 2012. To date, 18 Comet-ME micro-grids are under concrete legal threat, with more than 2,000 people depending on these systems for livelihood, lighting, refrigeration, and other basic needs. The central pillar or our legal argument is based in International Humanitarian and International Human Rights Law, under which Israel is obligated as the occupying power to provide basic services to the protected Palestinian population or at the very least not to demolish humanitarian infrastructure installed by third parties. The obstruction of projects providing energy and water services in Area C is thus a direct breach of Israel's obligation as the occupying power to fulfill the basic needs of the occupied population under international law.

Confiscation and retrieval of micro-grid in Jib a-Dhib

On June 28, 2017, the Israeli Civil Administration entered the village of Jib a-Dhib in the Bethlehem district, seized 96 solar panels, broke into and vandalized the electricity room, and seized several essential electronic components—all part of a micro-grid that had been providing the community with electricity since November 2016.

A concerted legal campaign was led by attorneys Michael Sfard and Michal Pasovsky on behalf of Comet-ME and the village of Jib a-Dhib, represented by the Women's Council there. These legal efforts, conducted in parallel with diplomatic efforts on the part of the Netherlands Foreign Ministry, yielded fruit, and on September 19, one week before the Supreme Court hearing date, the State submitted its response along with a response from the Head of the ICA, instructing to release the equipment immediately and without terms. On September 25 the equipment was retrieved and on October 4, 2017, the micro-grid was reinstalled in its entirety and power restored to the community of 160 women, children, and men.

On opposite page: Above, on June 28, the panels being driven away by ICA pick-up trucks after being seized; the empty solar-panel mounts. Below: Three months later, after retrieving the seized equipment, the Comet-ME team makes a lightning-quick effort to reconnect the system, while the community helps out.

Photo Guy Butavia

Photo Guy Butavia

Photo Ryan Brand

Photo Abd Qabajah

"The fundamental importance of electricity in the 21st century cannot be overstated, nor can the severe repercussions of its denial on the ability of people to find their place in modern life [...]. The extent to which we take electricity for granted in our own lives can be felt only when it is taken away. For most of us, if this happens, it is for moments, perhaps hours, during which life is on hold as we wait for the electricity to "come back on." But what happens when life goes on this way not for moments or hours but for years? [...] From within the boundaries of tradition [the women of Jib a-Dhib, who led the community's struggle for electricity] have been leading change and giving hope for the development of their village. If only they will be given the tools, they will lead their village into a new era. The lack and denial of electricity is an obstacle in the way of the village's progress, and in the longer term, a threat to its continued existence." From the expert opinion of social anthropologist Shuli Hartman, submitted as part of our Supreme Court petition to retrieve the seized micro-grid.

THANK YOU

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Photo Ryan Brand

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