



# 2016 ANNUAL REPORT



# EXECUTIVE SUMMARY

2016 was a very exciting and productive year for Comet-ME, with considerable organizational growth and expansion of the geographical scope of our work. Through our installations, we have brought reliable access to electricity and clean water to over 100 families throughout Area C of the occupied Palestinian territories and thus contributed to the improved livelihoods and resilience of vulnerable communities. With our maintenance and monitoring programs, we have ensured the longevity of our systems and the sustainability of the services we provide and increased the capacity of the beneficiaries to care for their own systems. Through our legal efforts, we have helped protect our systems from the threat of demolition.

Comet-ME has become somewhat of a household name among stakeholders in the occupied Palestinian territories working towards increasing community resilience in Area C, and the added value of our work as a joint Israeli-Palestinian organization has not gone unnoticed. This year has brought with it unprecedented collaboration between Comet-ME and Palestinian partners, from the local to the regional and national level. These connections, and our growing reputation as a reliable service provider and a unique player in the field, accompany us as we go on to expand our programs even further in the years to come.



*photos: Ryan Brand*

# ABOUT US

## 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-lasting relationship and commitment to the marginalized Palestinian communities in Area C—from our base in the south Hebron hills and now as far north as the Ramallah area. 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 45 communities encompassing over 4,000 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 households throughout our energy install base. 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.

Over a decade of experience in the field, we have seen how the provision of basic energy and water services to the marginalized communities in Area C has proven to be an effective means for community empowerment and economic development, allowing communities to choose their own paths while adapting our services to their evolving needs. Since the establishment of Comet-ME's 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.

**Founders and directors**

Elad Orian, General Manager  
Noam Dotan, Technical Manager

**Energy project manager**

Ahmad Almasry

**Water project manager**

Abd Aljawad Qabajah

**Maintenance manager**

Waseem Aljabari

**Design engineer**

Ryan Brand

**Technicians**

Moatasem Hadalin, Muhammad Aqeel,  
Musab Shrouf, Ibrahim Mhamara, Dahham  
Abu Aram, Khalil Shehadah Abu Sabha

**Water lab technician**

Ahmad Sayareh

**Community outreach coordinator**

Muhanad Alkharaz

**Organizational development manager**

Tamar Cohen

**Financial management**

Basheer Abu Baker, CPA

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*Photo: Ryan Brand*



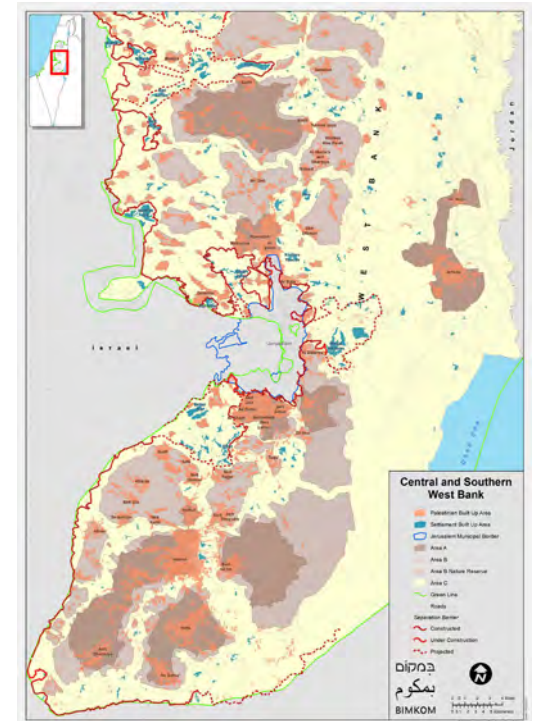
## WHERE WE WORK

Comet-ME works exclusively in Area C of the West Bank, where lack of access to infrastructure is a direct result of the Israeli occupation and its policies. Area C, under full Israeli military and civil control, constitutes 62% of the West Bank and is the only remaining land and agricultural reserves for a viable future Palestinian state and economy.

The planning regime imposed by Israel in Area C severely discriminates against the Palestinian population: Jewish settlements—all of which are considered illegal under international law and some even by the Israeli government—enjoy electricity, running water, sewerage systems, and access roads. Palestinian communities that have lived on their lands for generations and generations, on the other hand, are denied these basic services and live under the constant threat of demolitions and forced displacement.

Comet-ME's base of operation is in the south Hebron hills region of the West Bank, home to several thousand Palestinian farmers and shepherds living in caves and tents. Often referred to as the "cavedwellers," the people in these communities subsist on non-mechanized agriculture and herding. Life in this semi-arid region (with an average annual rainfall of less than 250mm), and constant exposure to the elements makes day-to-day life a matter of sheer survival.

The poverty and marginalization of the communities we serve is a product of the political situation more than of geography, climate, or the economy. Our work is motivated by the desire to ease the lives and increase the resilience of communities afflicted by conflict and political violence.





*Photo: Tomer Appelbaum*

### **SO CLOSE YET SO FAR**

In Area C of the West Bank, rural Palestinian villages' distance from the grid is 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. On the hilltop, the grid-connected settler outpost of Avigail; in the foreground, the Palestinian herding community of Shaeb al-Buttum, which has been receiving electricity services from Comet-ME since 2011 and clean running water services since 2014.

## HOW WE WORK

In the bottom-up tradition and spirit of appropriate technology, we espouse a dynamic, needs-driven approach to our technological developments and applications. We have dedicated a great deal of thought and effort to developing our technical and social model over the years, based on user feedback and lessons learned in the field. Moreover, we recognize that in highly technological projects such as ours, knowledge dissemination is an integral part of community empowerment. We base our work on the following core principles:

### 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 such as Engineers Without Borders, Wind Empowerment Association, the UN Sustainable Energy for All Practitioner Network, and the Centre for Affordable Water and Sanitation Technology, 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.

### Local sourcing

Comet-ME procures inputs from local manufacturers whenever possible. Most of the installation materials are purchased from suppliers in Yatta, Hebron, and Ramallah. Building the wind turbines ourselves is a central aspect of our work. By developing the knowledge and practice in the field of renewable energy we invest in local tech infrastructure.

### Community

Community participation and trust-building is an integral part of 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.





Photo: Yoray Liberman

### **BUILDING CAPACITY, ENSURING PROFESSIONALISM**

Comet-ME's energy project manager, Ahmad Almasry, provides an initial use and training session for a newly installed family-based energy system. Comet-ME implements a varied training and capacity-building scheme, taking into account the different types of systems we install (micro-grids, family-based energy systems, and water systems). Users and community representatives are trained in basic upkeep and troubleshooting. They are the link with our maintenance team to ensure that no problem, big or small, goes unattended—thus ensuring the longevity of the systems and the services we provide.

## TOTAL INSTALL BASE 2016

**45** Communities

**4,000** Beneficiaries

**7** Schools

**10** Wind turbines

**950** Solar panels

**142** Household water systems

### THE YEAR IN NUMBERS

In 2016 the Comet-ME team completed its largest installation project to date, expanding geographically from the south Hebron hills to cover much of Area C of the southern West Bank and as far as the Bethlehem and Ramallah areas. We installed renewable energy systems in 20 communities, providing a total of 348 solar panels, 57 water systems, and 1,670 meters of water pipeline to unserved communities. We provided 111 families and 850 individuals with electricity, 56 families and 350 individuals with clean water services, and we connected 3 schools, 2 clinics, 1 mosque, 1 kindergarten, and 5 small businesses.







# 2016 ACTIVITIES REVIEW

## COMET-ME 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.

As part of our buy-in philosophy, beneficiaries pay an electricity bill via prepaid custom-designed meters. This not only rationalizes the use of energy but also creates a sense of ownership and responsibility for the community's property, and contributes to the future maintenance of the systems.



*Photo courtesy of Osie Adelfang*





Photo: Comet-ME

### THINGS WE TAKE FOR GRANTED

Comet-ME's energy program is improving lives in many ways. Providing basic necessities for public health such as refrigeration of food and medicine; aiding livelihoods and community development with appliances such as butter churns and lighting that lets students finish their homework after dark; easing women's labor with washing machines and water pumps; and enabling the simplest pleasures such as eating an ice-cream on your front stoop.

## New Micro-Grid in Jib adh-Dhib

Between May 2016 and January 2017, Comet-ME implemented one of its most ambitious projects to date—the electrification of the village of Jib adh-Dhib in the Bethlehem area and the laying of a new water line there. Jib adh-Dhib (“Well of the Wolves”), abutting the Herodion archeological site and in the proximity of several large settlements, including Nokdim and Teqoa, and just 350 meters from the outpost of Sdeh Bar, is defined as part of Area C under the Oslo Accords.

Jib adh-Dhib is distinct from the communities Comet-ME has worked with in the past, due to its semi-urban character (which dictates different needs and expectations with regard to electricity and water service), and because all of the neighboring Palestinian towns are in Areas B and A and are served by the PA. According to Human Rights Watch,<sup>1</sup> the residents of Jib adh-Dhib have been trying in vain to get a permit for a grid connection from the Israeli Civil Administration for the past three decades. In the past two years, the Women’s Council of Jib adh-Dhib has taken upon itself to try to bring electricity to their village. The project was carried out in close cooperation with the Women’s Council, as well as the Bethlehem governorate, the West Bank Water Department, and the Beit Ta’amir local council.

With a 96-panel (30 kWp) solar array, the Comet-ME electricity micro-grid in Jib adh-Dhib provides electricity at present to 31 families (160 people ) the village mosque and kindergarten, as well as 5 businesses (a seamstress, beauty salon, two chicken farms and a mini market) and a weekly mobile health clinic. The system is designed with considerable growth in mind over its expected life time of more than 10 years. In the coming year alone, the community anticipates the return of many families to the village.

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1 Human Rights Watch, “[Separate but Unequal: Israel’s discriminatory Treatment of Palestinians in the Occupied Palestinian Territories](#)” (2010).





*Photo: Tomer Appelbaum*

### **A COMMUNITY RESOURCE**

The 96-panel (30 kWp) solar array is located on leased land next to the Jib a-Dhib village mosque—in the heart of village life. The children in the village know they must take good care of this community resource, because if they don't they won't be able to use their laptops!



Photo: Ryan Brand

### HI-TECH, GRASS-ROOTS

We use only top-of-the line components in order to ensure the robustness of the systems under conditions of extreme exposure to the elements, especially heat. The electricity rooms house batteries, inverters, and metering. Here, three SMA 8 kW Sunny Islands inverters bring power to the batteries and homes from the SMA Sunny TriPower 25 inverter.

The Jib a-Dhib Women's Council (pictured below) was an instrumental partner in the planning and implementation of the project. Their goal is to help make their village self-sufficient and not reliant on nearby towns for basic needs. They hope to instill a sense of pride in their children and to bring people back to the village, where lack of power has been driving young people to other locations.





Photo: Tomer Appelbaum

## Family-based solar energy systems

Comet-ME's custom-designed family-based solar system (FBS) provide 2-2.5 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 2016, we installed FBS's for 84 families in 20 different communities throughout Area C – from our base in the south Hebron hills, throughout the southern West Bank, and even as far as the Ramallah area.



*photo: Yoray Liberman*





Clockwise from top left: setting up an outdoor lamp for nighttime safety and convenience; hooking up an electricity box inside a home; programming the electricity cabinet; a 3-panel (900 Watt) solar array for a family-based system, providing 2.5 kWh of power per day per family.

## Maintenance program

Regular maintenance and upkeep of our systems is a central component of Comet-ME's methodology. Our maintenance team is responsible for overseeing routine maintenance and conducting regular safety checks, monitoring, and evaluation to ensure that the energy services Comet-ME provides match the needs of the communities. The team makes field visits, responds to emergency system failures, educates community members about proper use and upkeep of the systems and basic diagnostics, implements upgrade work, and collects the payments for the maintenance savings fund.

In 2016, the team conducted more than 150 visits to installations in different communities. We implemented system upgrades in six communities, extended our micro-grids to 20 families and 65 structures, and brought electricity connections to schools and clinics. We held our annual training refresher course for community and household representatives in veteran communities and initial training courses for new beneficiaries.



*Photo: Ryan Brand*





Community supervisors training  
Photo: Comet-ME

## 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 2016, we installed 57 water systems, bringing our total water install base to 136 households and 5 schools, serving about 2,500 people.

You can read our recently-published report, "Comet-H2O: Provision of Sustainable Water Services to Palestinian Communities in Area C," [here](#).





*Photo: Tomer Appelbaum*

### **SIMPLE AND AFFORDABLE TECHNOLOGICAL SOLUTIONS**

Based on renewable energy from the households' energy systems, Comet-ME's water pumping, distribution, and filtration systems provide a household-level water solution that vastly improves the quality of drinking water and greatly reduces the amount of time and labor dedicated to household water management. In our systems we use a traditional filtration technology known as slow-sand filtration. We adapted the design of our bio-sand filter from an open-source design by the [Center for Affordable Water and Sanitation Technology](#) to the local market and developed a PVC version of the filter container, which is now being produced for Comet-ME's H2O project by a local Palestinian manufacturer.



## Water-quality monitoring and capacity-building

Just as in our energy installations, following program, of the water systems, the owners/users of the systems are integrated into Comet-ME's monitoring and support scheme. The scheme includes initial training sessions, regular water-quality monitoring, response by water team members to problems, and user assessment to improve the system's design and operation. Close monitoring and water testing, along with regular cleaning and maintenance of the bio-sand filters, water containers, and tubes, is essential for maintaining high water quality.

The results of the testing have been overwhelmingly positive, consistently showing WHO-standard contamination levels ( $<10$  CFU/100 ml). The testing also provides us with an indication as to changes in usage or even incorrect usage by some of the families. We have discerned a direct correlation between the positive results from the bio-sand filter (as shown in the lab results) and proper upkeep as well

as regular usage of the filters. This year, especially, we noticed an improvement in results for households in their second or third year in the monitoring scheme.

Having clean drinking water has a big health impact, especially for children, the elderly, pregnant women, and people with chronic illnesses.

We cannot underestimate the role of education and awareness-raising. We acknowledge and respect the great importance of the role of women in increasing awareness in the household and instilling the habit of drinking water only from the filter, especially in their children.



*Photo: Comet-ME*



18-month-old Dallal serving herself a cup of filtered water.

*Photo: Tamar Cohen*



# THE COMET-ME CENTER FOR APPROPRIATE TECHNOLOGIES

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 our communities, 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: Tamar Cohen





*Photos: Ryan Brand*

### **ON-THE-JOB TRAINING**

Comet-ME builds and maintains its wind turbines in-house. This allows us to make quality products without dependence on commercial suppliers, modify the turbines according to our needs and experience, and simply build a new part when something breaks. The design we use is a modified Hugh Piggott turbine. The constant production of wind turbines allows the team to gain experience in a variety of techniques, including metalworking, woodworking, and casting.

# RESEARCH & DEVELOPMENT OF OFF-GRID PUMPING TECHNOLOGIES

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.

Over the past three years, Comet-ME focused its R&D efforts on developing a simple, reliable, and low-cost solar-powered water pump targeting the poorest farmers in the Global South. Since we began in 2013, the Solar Magnetic Piston Pump (SMPP) has gone through several technological development cycles and is close to reaching the performance specifications we have defined (pumping 10 cubic meters / day at 30-meter head). In early 2016, the pump design underwent an external review by Water Mission. The evaluation was very positive overall, and the feedback has helped guide our development work in the months since then.

In the coming year, we will be working on the integration of the pump motor with the electronic components (motor driver and MPPT power optimizer). In parallel, we are working on the development of our own proprietary check-valve concept and pump-packaging. The objective of the coming year is to complete the integration of all of the sub-components into a pilot-ready prototype.



Photo: Comet-ME

Testing the solar pump at the Comet-ME center

## LEGAL PROTECTION

Lack of permitting for development projects in Area C continues to be the most significant obstacle to rural development in the West Bank, including off-grid infrastructure projects such as ours. 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, thus securing Israeli demographic dominance in the only remaining open areas 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, 17 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. Needless to say, the obstruction of infrastructure projects in Area C by the Israeli authorities is not only a controversial policy, but also a direct breach of Israel's obligation as the occupying power to fulfill the basic needs of the occupied population under international law.



*Photo: Ryan Brand*

Through concerted legal efforts over the past five years we have managed to forestall the demolition of Comet-ME's facilities in Area C, 17 of which are under concrete legal threat. More than 2,000 people depend on these systems for their livelihood and basic human needs. Thanks to intensive legal work, both within the Civil Administration and in the Israeli High Court, we have succeeded to date in protecting all of these systems.



## LOOKING AHEAD

Comet-ME's plans for 2017 focus on three core activities: energy, water, and solar-pump development. In our energy program, we are expanding our services to 200 new families throughout Area C, while continuing to provide reliable maintenance services to all the communities in our install base.

In our water program, we will provide household water systems to 80 families while further expanding and developing our water-quality monitoring program.

In our pump-development program, we continue to advance and improve the design of our solar magnetic piston pump, while seeking partnerships throughout the developing world to begin beta-site testing in the first half of 2018.





*Photo: Ryan Brand*

## THANK YOU

Comet-ME is grateful for all the local and international donors, partners, research institutions and individuals who have made our work possible through support, advice, and collaboration.

### Donors

German Foreign Ministry  
Netherlands Ministry of Foreign Affairs  
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**And to all the individual donors who have supported our work and placed their trust in us.**

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CAWST – Centre for Affordable Water and Sanitation Technology  
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Hugh Piggott and Scoraig Wind  
Wind Empowerment Association

### Sharing the Challenge

Association for Civil Rights in Israel  
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Ta'ayush



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