

Biosirus Inc.

Smart Energy Solutions



Our Edge

Smart energy solutions (across many verticals) with a focus on retrofit, scalable, quick ROI, eco-friendly, energy-efficient and last-mile (distributed & discretized) architecture.

We strive to bring superior technology solutions, yet simple in functionality that can be readily retrofitted by most non-sophisticated small customers.

We think of small differentiated details from the global customer's perspective. Our retrofit, offers quick payback, low energy solutions, that truly benefits all customer segments.

Solutions Portfolio:

- Smart Energy
- Smart Cities
- E-Mobility infrastructure
- Water/Wastewater
- Solid Municipal Waste
- Energy Efficiency
- Rural Energy Access

About Us

We are a small boutique Canadian advisory company built on global utility expertise. Our focus is smart energy solutions.

We are not a Project Manager, EPC contractor or a product manufacturer. We offer select products as a value-added reseller.



Our Business

We cater to industrial, commercial, municipal and utility customers, advise SMEs in their technology development and assist academia in their innovation & research.

Our best challenges have come from emerging markets (EE, EV, DERs, ESS and Rural Energy access), in hot, sticky climates with limited affordability.

Non-traditional partnership/channels offer the best business prospects and ideas for us. We scout the world for such select technologies.

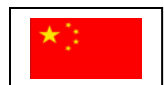
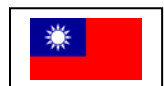
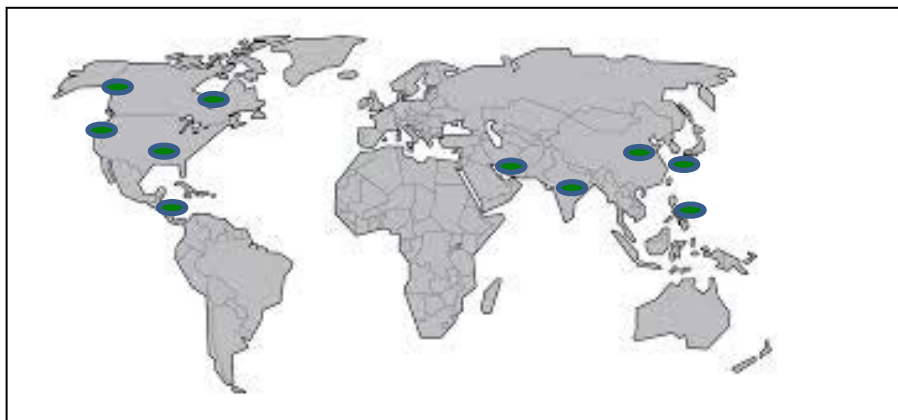
Our Approach

We work with clients, their asset managers/engineers. *Our differentiated details focus on retrofits for quick payback.* We are not IP focused, but believe, connecting globally, provides unique recognition for our solutions.

Global Clientele:

- Canada
- USA
- Middle East
- India
- SAARC Countries (Asia)
- Far East (Asia)
- Central America
- Latin America

Alliances / Activities



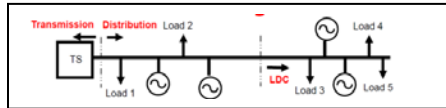
Advisory Services



Smart Grid

Utility T&D and Industrial:

- Microgrids & Hybrids
- DER integration, Energy Storage, Distributed Generation
- Power Quality, Short Circuit Mitigation, Phasor Measurement Units
- Distribution Automation



Smart Cities

Municipal, Utilities and Communities:

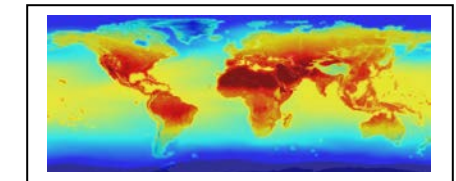
- Mapping technology to community objectives
- Resilient energy infrastructure
- Energy Efficiency; Conservation; HVAC, Demand Controlled Ventilation (DCV)
- Clean Urban Transportation



Climate Change

Impact Studies:

- Resiliency requirements for Electrical Infrastructure;
- Resiliency vs. Reliability Trade-offs
- Operationalizing Science Based Targets (SBT) and MDG targets



E-Mobility

Impact Studies:

- Grid Infrastructure impact
- Optimization of routes, vehicle battery sizing, charging infrastructure
- Cost-Benefit Analysis (TCO and NPV) and Business Case impact
- Public fleet (Buses, taxis, 3-wheelers, ferries)



Energy Access

Small Scale Rural Energy:

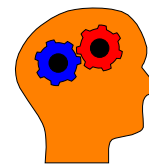
- Low Power rural amenities; Seamlessly scalable from 300W to 5KW+
- Energy infrastructure for rural economic development & community health
- Rural Off-Grid Systems (Micro/Nano/Pico Grids)



Roadmap/Applied R&D

Government, Universities and Industrial:

- Thought Leadership on complex matters
- Assist Academia in industrial R&D, new Centers
- Assist SMEs in product/technology development & markets



Assignments

Talks/Visits/Presentations: *Singapore, Indonesia, Malaysia, Philippines, Taiwan, Japan, India, UAE, Saudi Arabia, Qatar, Turkey, Slovenia, Panama, Chile, Colombia, Brazil, USA and many EU countries.* Co-Authored over 50 technical papers.

Expert Advisory Services:

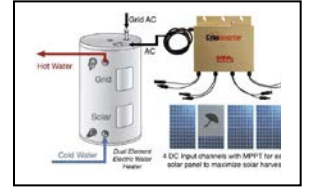
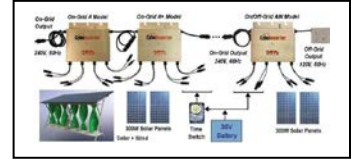
- Energy Storage Roadmap, for 40GW Rooftop PV Initiative, India
- Smart Grid Roadmap and EV Roadmap, SAARC countries
- Outsourced Generation Field Maintenance Service Business Model, Middle East
- Electrification of Public Transportation, City of Kolkata, India (2017)
- Innovation Report, Canadian College; MOU Energy Center, Panama University; R&D Support, Canadian University
- Technology/Product Development, SME companies, North America and Asia

Micro Grid and Energy Storage Solutions



Solar Hybrid Inverters (Grid-Tied /Off-Grid)

- **Application:**
 - Scalable Systems: 300W-1200W – Higher (easy daisy chained systems)
 - For Lights, Fans, TV, PC, Chargers, Refrigerators, Food Processors, Small Appliances
 - Benefits of standard AC components/appliances (wires, switches, equipment)
 - Urban: Residential, Apartments, Condos, Townhouse, Schools, Small Shops
 - Rural: Residential, Shops, Irrigation, Threshing/Grinding Mills, Hot/Boiled water
- **Features:**
 - Each Module: 1.15 KW (4 x 300W DC input); Individual MPPT for each solar panel
 - 100/110/120V; 220/230/240V; 50/60 Hz.; Ambient: -40 to +65 deg. C; Pure Sinewave
 - Solar or Battery auto-detection; Battery overcharge protection
 - Peak Eff. 96%; MPPT Tracking 99%; Built-in DC GF Detector/Interrupter



Smart Energy Storage Systems (Grid-Tied /Off-Grid)

- **Application:**
 - Scalable Systems: 5-15KW, 10-15 KWh ESS
 - Residential, Small Business, Community Centers
 - Scalable Options: PV Input, Grid Input, Backup Generator input, Load output
- **Features:**
 - Self Contained 5-15KW, 10-15 KWh ESS with Inverter and electrical sub-panel
 - Advanced 48V LFP Battery (6,000 cycles); Deep discharge to 90% DoD
 - All-in-One Configuration for very easy connections
 - 8x8 way programmable for TOU, FIT, Net Metering, Peak Shaving, Load Shifting, etc.
 - Electrical panel includes breakers for emergency sub-panel
 - Grid-tied or Remote application; With or Without Solar PV panels
 - Inverter capable of supporting any 48V battery (AGM, GEL, LFP, LiON, Others)



The system has grid support functions too (UL 1741 SA). The fixed power factor correction has a wide band of 0.7 pf (lead/lag). The frequency ride-through is 57-62 Hz, and the voltage ride-through is from 40-120% Vac. In addition, it has an auto Volt-Var (Q) function to maintain PCC voltage between 0.88-1.1 Un with maximum 3.5 KW and 3.57 KVAR (lead/lag) injections (ramp rate 500 Var per second).

Hybrid Energy Solutions

Battery + Ultra-Capacitor Systems

Residential, Commercial, Industrial, Automotive

- **Customized Ultra-Cap Applications:**
 - Hybrid with Lead Acid, LFP Batteries; Mitigation against everyday battery cycling
 - Allows for Lead-acid batteries as a viable option (despite low cycle-life)

Phase-Change Thermal Energy Storage Systems

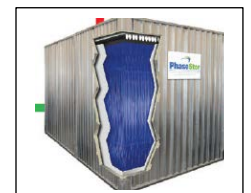
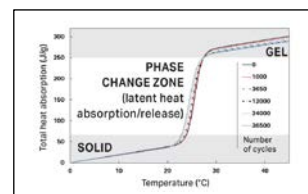
Residential, Commercial, Industrial

- **Customized Applications:**
 - PCM (Solid to GEL); Indoor Blankets; Outdoor Cubicles

Waste-to-Energy Systems

Small Agricultural, Commercial, Industrial

- **Customized Applications:**
 - Mobile Bio-gasifiers for Heat/Electricity/Syngas/Bio-char (10KVA–1500 KVA trailers)



Energy Efficient

Rural Energy Solutions



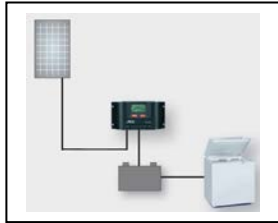
Solar Agro Processing

- **12/24/48V DC Systems with Charge Controllers – Complete Package:**
 - **Rice Mill Huller and Polisher** (up to 240/100 Kgs -Brown Rice /White Rice per day)
 - **Corn Huller and Flour Mill** (up to 200 kg/day from dried corn cobs)
 - **Coconut Scraper-Grater** (up to 60 coconuts/ hour)
 - **Cassava Grater** (up to 60 Kg/hour)



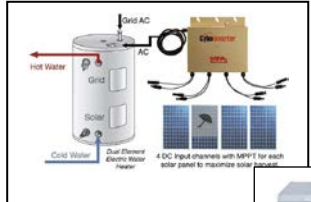
Solar “Mobile” Irrigation Pump-sets

- **DC Solar fed AC VFD-drives (120V/240V - up to 7KW)**
 - Pump-motor system tractor flatbed mount ;
 - Solar Panels – use customers or employ movable easy “ground-mount” kits
 - DC charge controller, inverter, VFD - all in one
 - Configurations: 100/110/120V; 220/230/240V; 50/60 Hz.;
 - AC motor deployed as it is easy to fix (than DC motors) in most rural communities
 - No Diesel or Batteries
 - Can supply housing load batteries if required during early morning and evenings
 - Typical pump operation (10am – 4:00pm) – 6 hours for larger pump-sets



Solar Heat/Cool Ancillary Systems

- **Solar Heating Systems:**
 - Boiled Water for community safe drinking
 - Warm water for other community washing services
- **Solar fed - Refrigerator/Freezer Systems (120/240V AC or 12/24 V DC)**
 - Chest Freezers 100-525 L (3.5-18.5 Cu. ft.) for medical, meats, other
 - Small Refrigerators 92-212 L (3.3-7.5 cu. ft.) for vegetables, perishables
 - **Freezer:** Input Power 70-110 watts; Temp. < -18 deg. C
 - **Refrigerator:** Input Power 62-77 watts; Temp. < 3 deg C



Rural Electrification Architecture

DC Source (15-48V)

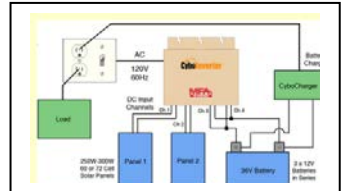
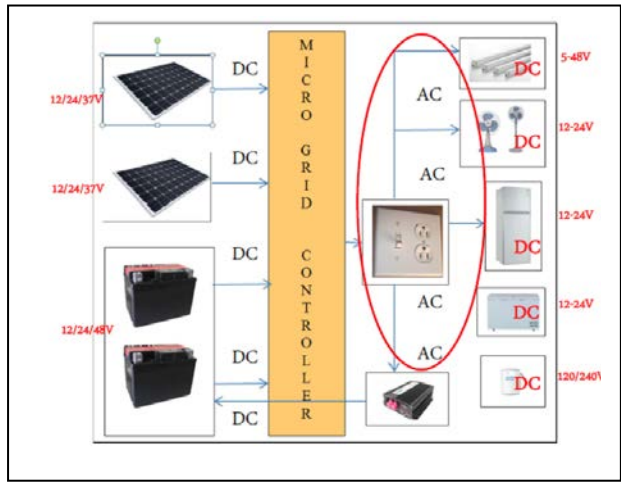
- Solar PV, Battery, Wind
- Scalable input

AC Delivery (120/240V; 50/60Hz)

- Longer wiring
- Higher loads & Scalability
- AC Standards / Market Parts

AC/DC Load (120/240V; 12-48V)

- Low energy/high efficiency
- BLDC low motor start current
- Inexpensive AC-DC Adapters



Energy Efficient

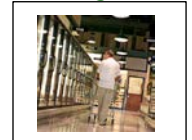
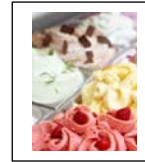
Advanced HVAC-R Solutions



Individual Unit HVAC-R Retrofit Controller

Single Stage or Dual Stage Compressors

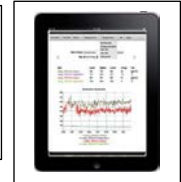
- **Suitability:**
 - Scroll or Reciprocating compressors (not centrifugal)
 - Works with existing thermostat controls (analog, digital, BMS – On-Off type)
 - Wired in series with existing thermostat and on the same circuit
 - Override /bypass capability; Fail Safe in Bypass Mode; Screen Display for data verification
- **How Does it Work:**
 - Dynamically analyzes compressor operation (on/off, cycling, rest-time); Does not violate thermostat settings
 - Predictive algorithm monitors & adapts to changing heat loads/compressor demand
- **Energy Savings:**
 - Payback: 1–3 years through less compressor operation time and efficient cooling
 - Compressors consume 75%-90% of energy – so less equates to more savings



Wi Fi Enabled HVAC-R Sensors

Various Sensors – Temp/RH/Dew Point/CO/CO2/People Significant Reduction in wiring costs

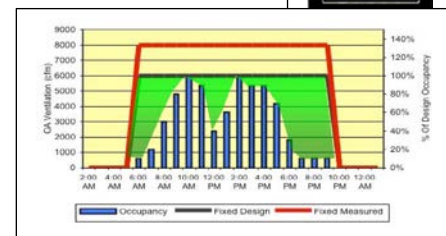
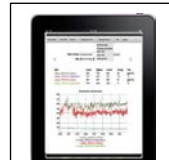
- **Application:**
 - Retail, Gyms, Auditoriums, Class-rooms, Hospitals/Clinics, Airports, Bus/Rail Terminals
 - Wi-Fi to Cloud/Internet/Wire (for BACnet, Modbus, SNMP); Babel Buster Gateway - up to 200 Wi-Fi sensors
- **How Does it Work:**
 - Battery Powered or Low Voltage (5-24V) AC or DC line supply
 - 12dBm 2.4 GHz 802.11 b/g WiFi Radio; Transmitter is configured using a plug in PC-USB interface
 - Encryption: Supports WEP128, WPA-PSK (TKIP), and WPA2-PSK (AES)
 - Communication Packets: Small data packets (~75 bytes), Supports DHCP or Static IP, Channel agility
 - Data Packet Spec Link: TR9299UDPSpec; Certification: FCC, CE, and IC Class B compliant



Demand Controlled Ventilation Systems

Monitored Feedback Control for Optimum Fresh-Air Intake – CO/CO2/People Tremendous Savings in Energy

- **Application:**
 - Indoor variable occupancy areas:
 - Retail, Gyms, Auditoriums, Class-rooms, Hospitals/Clinics, Airports, Bus/Rail Terminals
 - Mall or Office Buildings, Indoor Parking garages
 - Older buildings; High Electricity and/or Gas tariff jurisdictions
- **Features:**
 - Real-time CO₂ monitored feedback for fresh-air intake damper control
 - Variable Occupancy Savings and Over-ventilation energy savings
 - Real-time monitoring, control, alarm notifications, data logging
- **How Does it Work:**
 - Low levels of indoor CO₂ (< 400 ppm) denotes low occupancy and/or excessive ventilation
 - High levels of indoor CO₂ (> 1100 ppm) denotes very high occupancy and/or lack of ventilation
 - Feedback loop control to Air-handling /damper control based on CO₂ levels



Energy Efficient

Load Management Solutions



Theft Deterrent Power Metering

Tamper Resistant; Optical Sensing; Wireless Communications

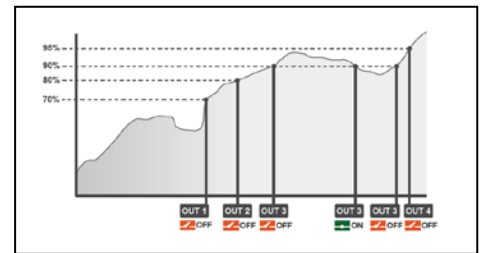
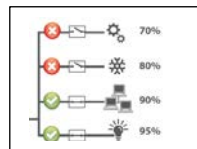
- **Suitability:**
 - Theft Proof Metering Box; Tamper detection; Totalizer for every 10 meters
 - 30-50 meters (each two 100A relays for remote connect/disconnect)
 - Programmable meter current limit (1 to 100A); Can act as CB
 - Scalable Wireless Communication mesh to Gateway
 - Meters communicate optically inside box (increased security)
 - Centralized customer Display; Prepaid Metering enabled (STS)
 - Capable of elevated mounting; 15-34KV "wire wrap" around box



Demand Management

Demand/Load Controller

- **Suitability:**
 - Industrial, Commercial, Other; 110/240V, 50/60Hz.
 - Single/Three Phase (3W/4W); Onboard Analyzer
 - Four Output Relays (6A); Activation by percentage level (programmable)
 - Measuring accuracy: Power 0.5%; Energy 1%

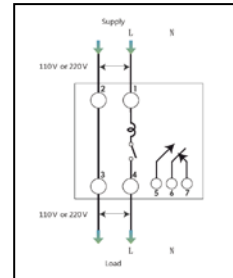


Available KVAR Controller

Sub Metering

CB Power Meter; Load Switch Sub-Meter

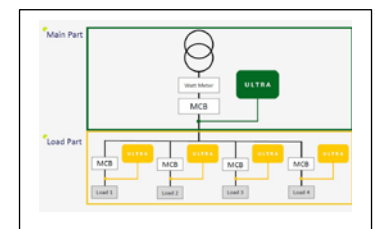
- **Suitability:**
 - Industrial, Commercial, Residential, Other
 - 1-Phase 2Wire; Accuracy 1%; 90-260V; Dim. 5x13x7 cm.
 - Measurement communication RS 485
 - 1 x 80A Relay (0.1A – 60A programmable); 1NO/NC dry contact
 - Load Shedding



Energy Saver - Ultra

Main Incomer or Branch Circuit or Individual Loads

- **Suitability:**
 - Industrial, Commercial, Residential, Other
 - Single/Two/Three Phase
 - Capacity: 0.5 KVA – 1500KVA; 100– 600Vac; 50/60 Hz.
 - Compact form-factor; Wall mount; No auxiliary power supply needed
- **Performance:**
 - Energy Savings: Min 5%; Average 8-15%; Inductive Loads 11-18%
 - Average Lifespan: 10 years
 - Certification: CE, TUV, TGM, UL, CSA
 - Value for Money



Energy Efficient

Advanced Lighting Solutions

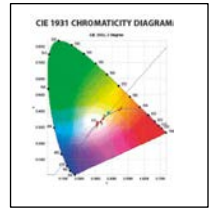


Advanced LED T8 (Replace T8/10/12 FL)

9/ 13/17.7 /34 Watts; 2 ft (603mm) / 3 ft (907mm) / 4ft (1212mm) / 8 ft (2380mm)



- **Suitability:**
 - Operates with existing electronic/magnetic ballasts; No removal, No bypass
 - Can be connected direct to 120V or 240V ac supply
 - Replaces Fluorescent tubes (T8/T12)
 - High CRI >80; R9>8; Wide Colour Temperatures: 3500K – 5000K
- **How Does it Work:**
 - Revolutionary integrated universal power supply (inside tube)
 - Design-Lights Consortium (DLC) Qualified
 - Long Life: 80,000 hours; High Lumen maintenance L70>50,000 hours)
- **Energy Savings:**
 - 50% energy savings compared to T8/T12
 - High Power Factor ≥ 0.985 (lower Demand Charges)



Advanced LED Lighting

High/Medium/Low Bay; Streetlights; Wall Packs, Corn Lights

Panel Lights: 20-75 Watts; 300 x 300-1200mm; 600 x 300-1200mm; Custom

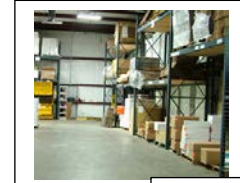
- **Suitability:**
 - Indoor/Outdoor; Industrial, Commercial, Residential, Streetlight
 - IP64/65/67; UL, DLC; Long Life: 80,000 hours; L70>50,000 hours; Ambient -40 to +50 deg C
 - Voltage Supply: 110/240V; CRI>80; R9>10; pf>0.95; Efficiency>100L/Watt; CCT: 2800K-6500K
- **How Does it Work:**
 - High Quality long-life LEDs; Long Life Drivers; Good Thermal design
 - Uniform lighting, no dark areas; Large lighting surface area (less shadow effects)
 - Pre-selectable Parabolic lens (15-132 degrees)
- **Energy Savings:**
 - Energy saving > 60%-75%
 - High Power Factor ≥ 0.95 (lower Demand Charges)



Advanced Induction Lighting

100/130/160/200 Watts

- **Suitability:**
 - High Bay(10-30m); Medium (6-10m); Low (4-6m)
 - Streetlights and Perimeter /Wall-pack lights
 - Wide voltage range: 110V (80-140V); 220V (180-270V)
 - High CRI>80; R9>30 (True colour tri-chromatic); Wide Colour Temperatures: 2700K-6500K
 - Replaces Mercury Vapour, Metal Halides, High Pressure Sodium Lamps
- **How Does it Work:**
 - Electrode-less bulbs, Double Walled, Anti UV Nano Coated
 - Long Life: 60,000-100,000 hours; High Lumen Maintenance L70>60,000 hours
 - Cooler Lamp Temperature – 60 deg. C (versus 300 deg. C for MH/MV)
- **Energy Savings:**
 - High Savings: 100W AI Lamp Replaces – 200W FL (T5/T8); 400W MH; 500W MV
 - High Power Factor ≥ 0.98 (lower Demand Charges)
- RoHS, CE, C-UR, R43639, EMI Compliant

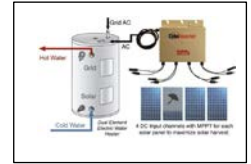




Small Ultra-Efficient Home Appliances

Small Ultra-Efficient Solar Electric Hot Water Heaters

- Off-Grid; Solar PV - 300Watts to 1.2 KW (and above);
- Electrically Heated (no periodic fluids change/pump issues like in solar thermal)
- Domestic Hot water uses; Boiled water Advisory; Thermal energy storage for space heating



Efficient "Downdraft" Biomass Gasifier Cook Stove

- Up to 40,000 BTU/h (12,000 W; Residential Use (Cooking, Hot water)
- Up to 200,000 BTU/h (60 KW); Merchant Services (Hot water, Other)
- Uses only 10% of wood fuel compared to "updraft" stoves; Venting required



Small Ultra-Efficient Electric Fans

- 4W and up; DC Motor technology;
- Table / Ceiling Fans



Small Ultra-Efficient Cooktops

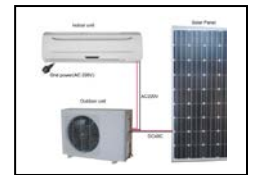
- Superconducting Heating and Infrared Technology; 100W-1400W (and above);
- More powerful than Induction Heating; No need to change utensils.



Ultra Efficient Split A/C Systems

9000 / 12,000 / 18,000 / 24,000 BTUs

- **Suitability:**
 - Residential /Small Commercial /Small Office
 - Grid-Tied/ Off-grid with Solar PV or Solar Thermal
 - Cooling only or Cooling/Heating, Hot Water option
- **How Does it Work:**
 - Ultra Efficient DC Inverter Compressor (BLDC) Motor aided by Solar PV/ Thermal
- **Energy Savings:**
 - High EER rating > 14.5 (BTU/h/W); > 5.3 (W/W),
 - Energy Savings > 35%

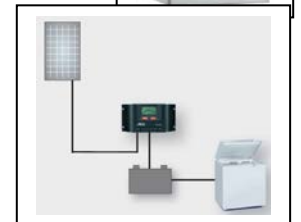


Ultra Efficient Refrigerators/Freezers

Chest Freezer: 100-525 Litres (3.5-18.5 Cu. ft.)

Refrigerator: 92-212 Litres (3.3-7.5 cu. ft.)

- **Suitability:**
 - Residential /Small Commercial /Small Office
 - Grid-Tied/ Off-grid with Solar PV; AC (120/240V) or DC (12/24V) Systems capable
- **How Does it Work:**
 - Ultra Efficient DC Inverter Compressor (BLDC) Motor; Noise < 40 dBA
 - Self-Defrosting; Refrigerant R600a/R134a
- **Energy Savings:**
 - **Freezer:** Input Power 70-110 watts; Temp. < -18 deg. C; Refrigerant R600a/R134a
 - **Refrigerator:** Input Power 62-77 watts; Temp. < 3 deg C (FR. <-18 deg C);
 - Energy Savings > 35%



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