

# Biosirus Inc.

## Smart Energy Solutions



### Our Edge

*"Weight management is essential for good health; Energy Efficiency is essential for energy sustainability"*

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

We think of small differentiated details from the global customer's perspective.

The solutions we offer, truly benefits all customer segments. High consumption, long hours of use and high electricity tariffs makes the business case very attractive with 1-3-year payback.

*This EE focus has brought opportunities in Rural Off-grid systems as well as in Hybrid Energy Storage applications.*

### 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 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.

### Our Business

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

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.

#### Clientele Mix:

#### National Roadmaps:

- o Energy Storage, Smart Grid
- o Electric Vehicles

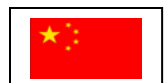
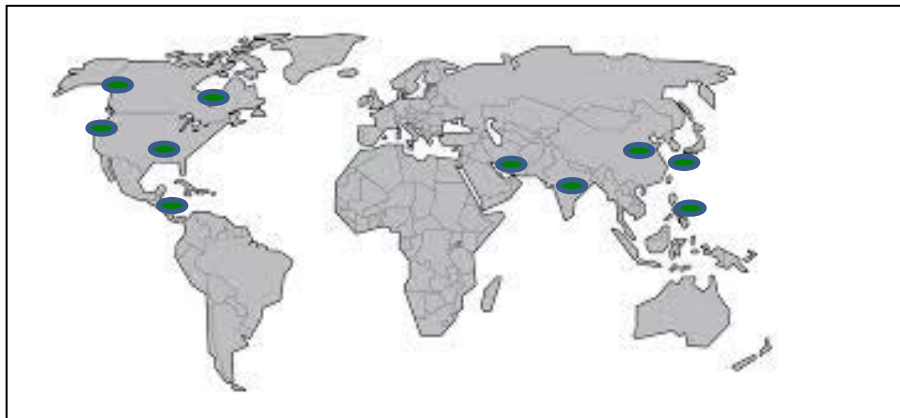
#### Utility:

- o Generation Maint. Services
- o EV Charging Infrastructure

#### SME / Academic:

- o Applied R&D Support
- o Product Development

## Alliances / Channel Partners / Activities



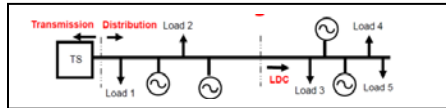
# Advisory Services



## Smart Grid

### Utility T&D and Industrial:

- Industrial Microgrids
- DER integration, Distributed Energy Storage, Feeder DER Hosting Capacity
- Power Quality, Phasor Measurement Units
- Short Circuit Mitigation
- Distribution Automation; Low Cost Scalable SCADA/DMS



## Smart Cities

### Municipal, Utilities and Communities:

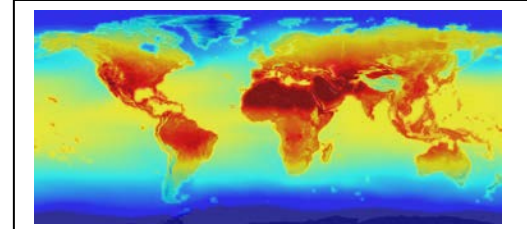
- Mapping technology to community objectives
- Resilient energy infrastructure
- Energy Efficiency; Conservation; HVAC, Demand Controlled Ventilation (DCV)
- Clean Urban Transportation



## Climate Change

### Impact Studies:

- Defining Resiliency requirements for Electrical Infrastructure;
- Resiliency vs. Reliability Trade-offs
- Operationalizing Science Based Targets (SBT) and MDG targets
- Business Case and impact analysis of EV adoption



## E-Mobility

### Impact Studies:

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



## Energy Access

### Small Scale Rural Energy:

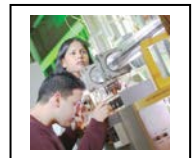
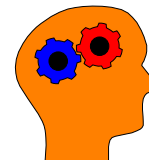
- Low Power rural amenities; Seamlessly scalable from 300W to 5KW+
- Energy infrastructure for rural economic development & community health
- Rural Off-Grid Systems (Micro/Nano/Pico Grids)



## Applied R&D

### Universities and Industrial Research Centers:

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



## International Presentations

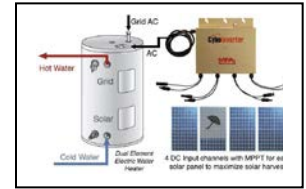
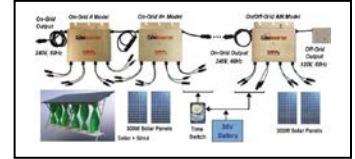
International Presentations: *Singapore, Indonesia, Malaysia, Philippines, Taiwan, Japan, India, UAE, Saudi Arabia, Qatar, Turkey, Slovenia, Panama, Chile, Colombia, Brazil, USA and many EU countries* on Smart Grid, Smart City, Renewables, Energy Storage, Energy Efficiency and Microgrid areas. Over 50 technical papers co-authored by executives.

# 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

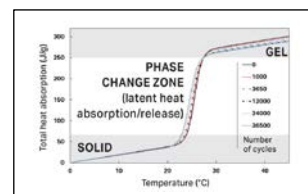
- **Customized Ultra-Cap Applications:**
  - Hybrid with Lead Acid, LFP Batteries; Mitigation against everyday battery cycling
  - Allows for Lead-acid batteries as a viable option (despite low cycle-life)



### 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



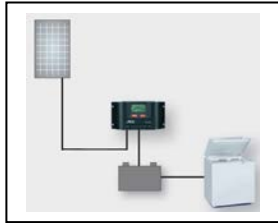
## Solar Agro Processing

- **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)



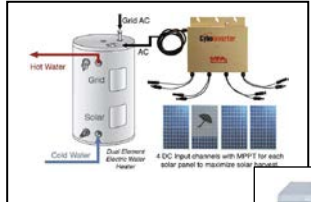
## Solar “Mobile” Irrigation Pump-sets

- **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)

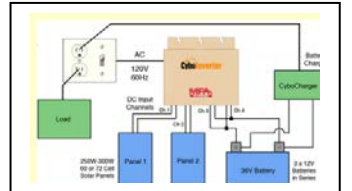
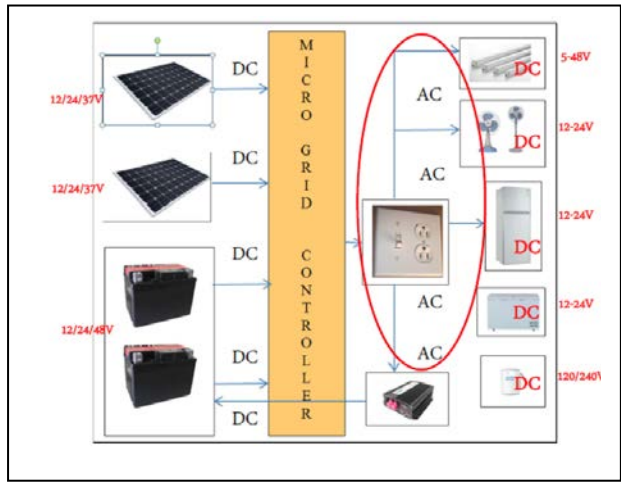
- Solar PV, Battery, Wind
- Scalable input

### 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

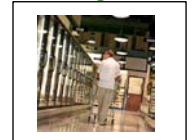
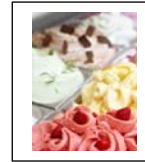
# Advanced HVAC-R Solutions



## 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

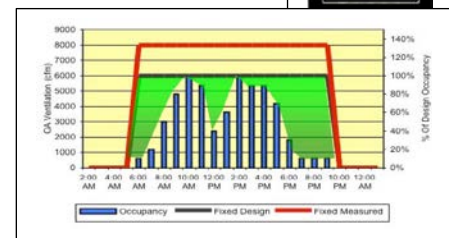
- **Application:**
  - Retail, Gyms, Auditoriums, Class-rooms, Hospitals/Clinics, Airports, Bus/Rail Terminals
  - Wi-Fi to Cloud/Internet/Wire (for BACnet, Modbus, SNMP); Babel Buster Gateway - up to 200 Wi-Fi sensors
- **How Does it Work:**
  - Battery Powered or Low Voltage (5-24V) AC or DC line supply
  - 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 CO<sub>2</sub> 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 CO<sub>2</sub> (< 400 ppm) denotes low occupancy and/or excessive ventilation
  - High levels of indoor CO<sub>2</sub> (> 1100 ppm) denotes very high occupancy and/or lack of ventilation
  - Feedback loop control to Air-handling /damper control based on CO<sub>2</sub> levels



Energy Efficient

# Load Management Solutions



## Theft Deterrent Power Metering

Tamper Resistant; Optical Sensing; Wireless Communications

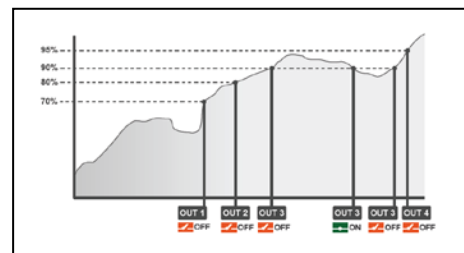
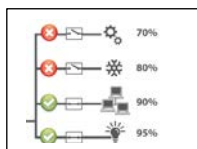
- **Suitability:**
  - Theft Proof Metering Box; Tamper detection; Totalizer for every 10 meters
  - 30-50 meters (each two 100A relays for remote connect/disconnect)
  - Programmable meter current limit (1 to 100A); Can act as CB
  - Scalable Wireless Communication mesh to Gateway
  - Meters communicate 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%

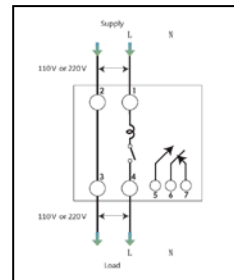


Available KVAR Controller

## Sub Metering

CB Power Meter; Load Switch Sub-Meter

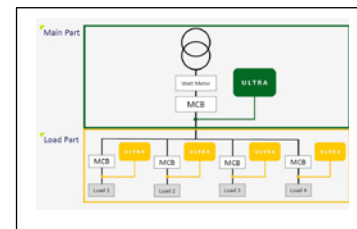
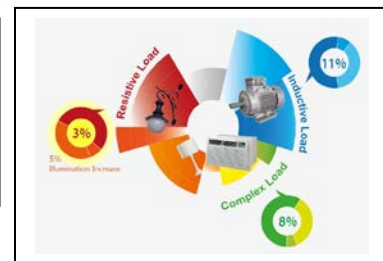
- **Suitability:**
  - Industrial, Commercial, Residential, Other
  - 1-Phase 2Wire; Accuracy 1%; 90-260V; Dim. 5x13x7 cm.
  - Measurement communication RS 485
  - 1 x 80A Relay (0.1A – 60A programmable); 1NO/NC dry contact
  - Load Shedding



## 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

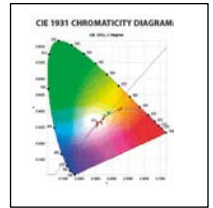


## Advanced LED T8 (Replace T8/10/12 FL)

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  $\geq 0.985$  (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

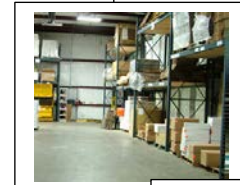
- **Suitability:**
  - Indoor/Outdoor; Industrial, Commercial, Residential, Streetlight
  - IP64/65/67; UL, DLC; Long Life: 80,000 hours; L70>50,000 hours; Ambient -40 to +50 deg C
  - Voltage Supply: 110/240V; CRI>80; R9>10; pf>0.95; Efficiency>100L/Watt; CCT: 2800K-6500K
- **How Does it Work:**
  - 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  $\geq 0.95$  (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  $\geq 0.98$  (lower Demand Charges)
- RoHS, CE, C-UR, R43639, EMI Compliant

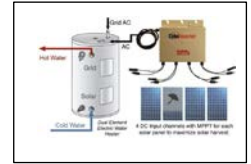




## Small Ultra-Efficient Home Appliances

### 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

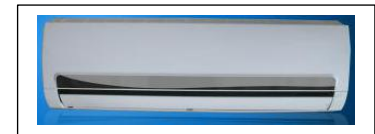
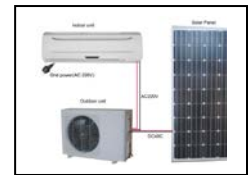
- Superconducting Heating and Infrared Technology; 100W-1400W (and above);
- More powerful than Induction Heating; No need to change utensils.



## 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%

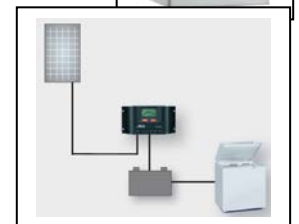


## Ultra Efficient Refrigerators/Freezers

**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%



### Biosirus Inc.

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