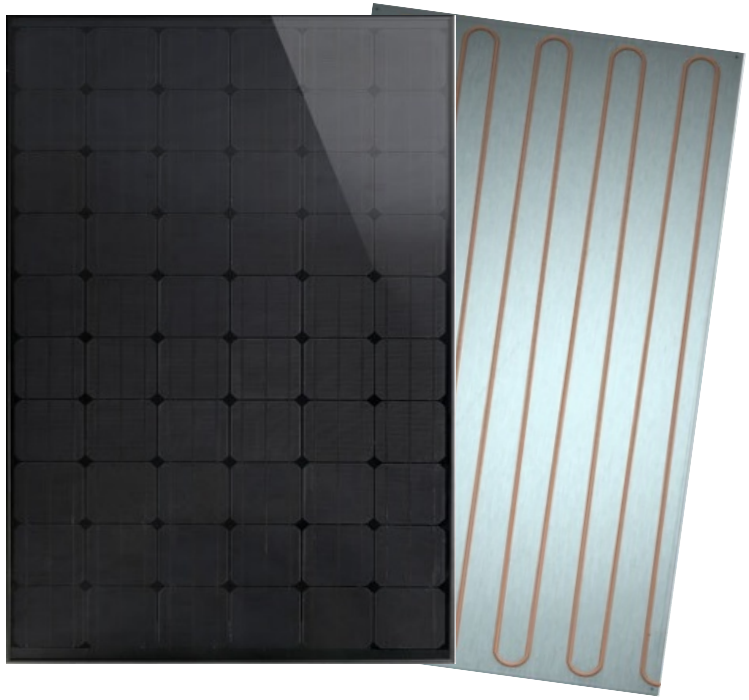
ART AND RENEWABLE ENERGY TECHNOLOGY

# TWINPOWER

***SOLAR ENERGY PERFECT***
***THE ONLY PVT THAT IS DISASSEMBLED***



PATENTED NO. 2016/06195 PATENTED

# New Era in Photovoltaic

design your future

**100%**

**best materials > exclusive technologies > measurement realization**

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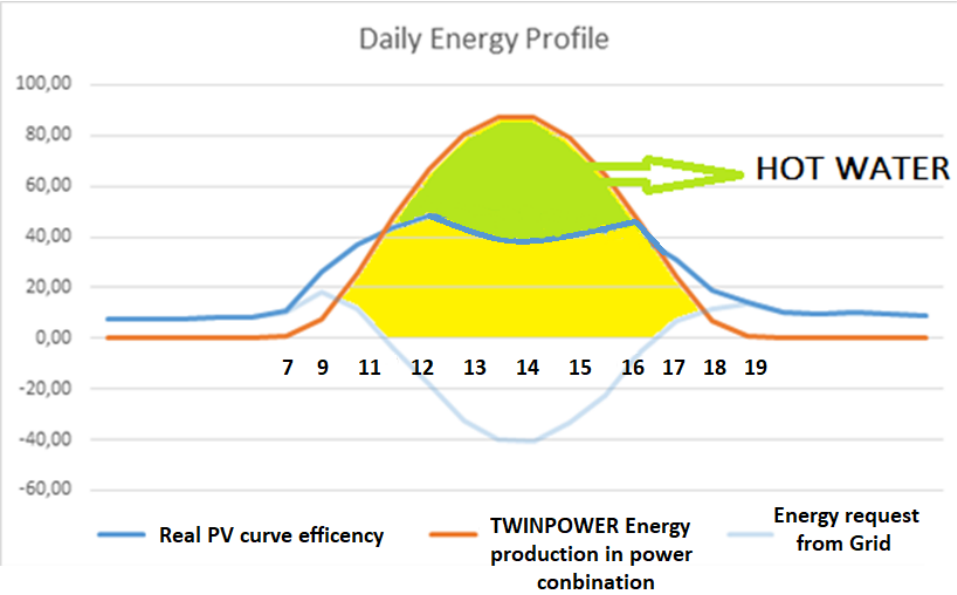
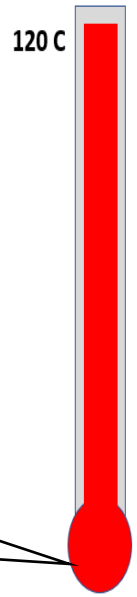
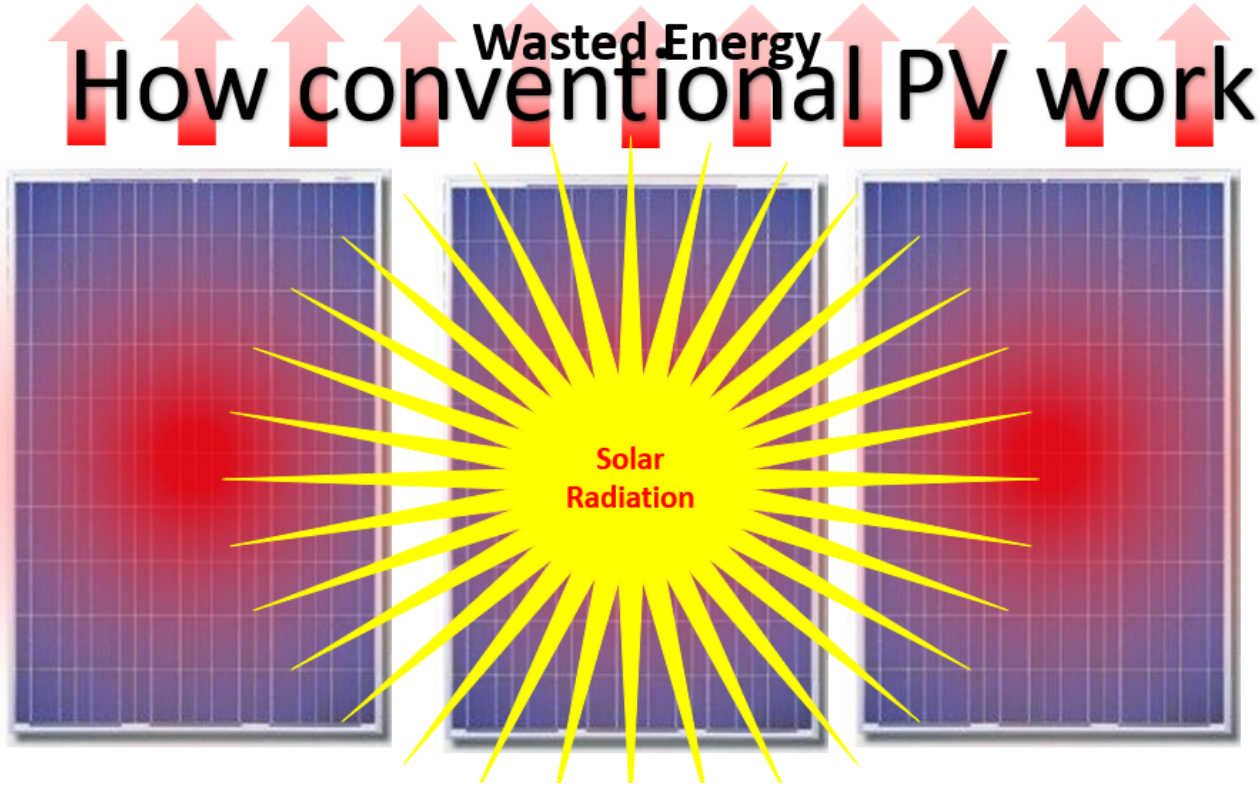



**TWINPOWER Lower the PV Temperature =**
**1) Better Efficiency (up 30% more)**
**2) Increase lifespan**




The High Temperature up to 120 C
- Reduces PV Efficiency (25-35%)
- Reduces PV Lifespan



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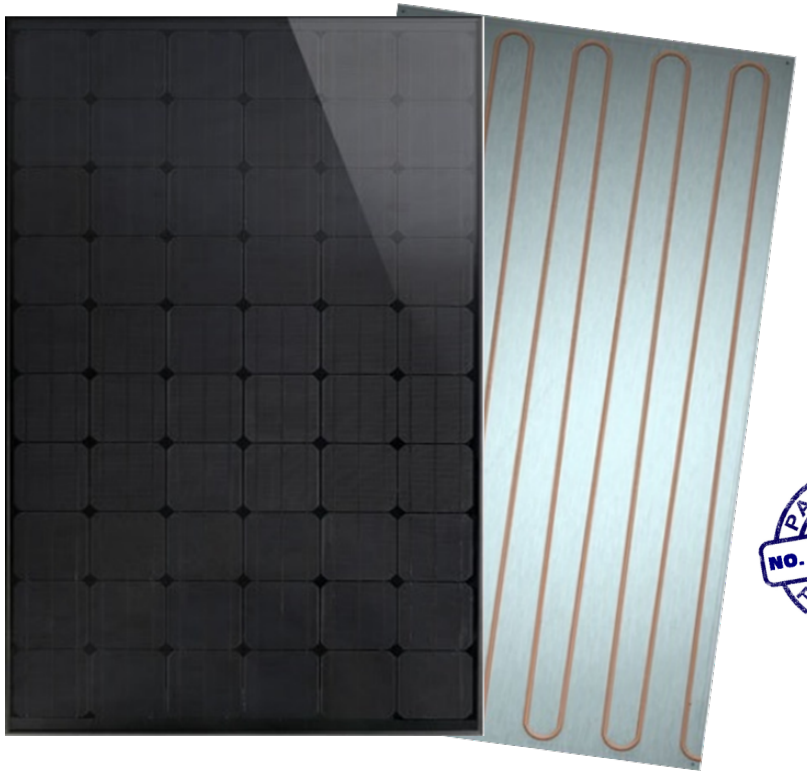
# TWINPOWER© BENEFIT

*SOLAR ENERGY PERFECT*

| FEATURES | BENEFITS |
|---|---|
| THE ONLY PVT THAT CAN BE DISASSEMBLED | SAVE MONEY IN CASE ONE OF THE TWO SYSTEMS WILL BE DAMAGED |
| COMBINED SOLAR ELECTRIC AND WATER HEATING SYSTEM | LARGELY ELIMINATES THERMAL HEATING COST, MAXIMIZING YOUR THERMAL COST INVESTMENT |
| THE INSTALLATION PLANT IS USUALLY 30% TO 40% SMALLER THAN THE NORMAL PV AND DOUBLE SYSTEM | GENERATES UP TO 300% MORE ENERGY FROM THE SAME ROOFTOP SPACE, SAVING YOU MORE MONEY |
| PV COOLING SYSTEM | INCREASE EFFICENCY OF THE PV UP TO 30% IN COMPARISON OF NORMAL PV IN SAME CONDITIONS AND INCREASE LIFESPAN |
| THE SYSTEM CAN BE CONNECTED TO THE ABSORPTION CHILLERS | REDUCES THE CHILLER ELECTRICITY CONSUMPTION UP TO 100% |
| PHOTOVOLTAIC AND THERMAL IN A SINGLE PANEL | BETTER AESTHETIC, LESS IMPACT ABOVE THE ROOF THAN NORMAL DOUBLE SYSTEM FOR THE SAME ENERGY |



PATENTED NO. 2016/06195 PATENTED

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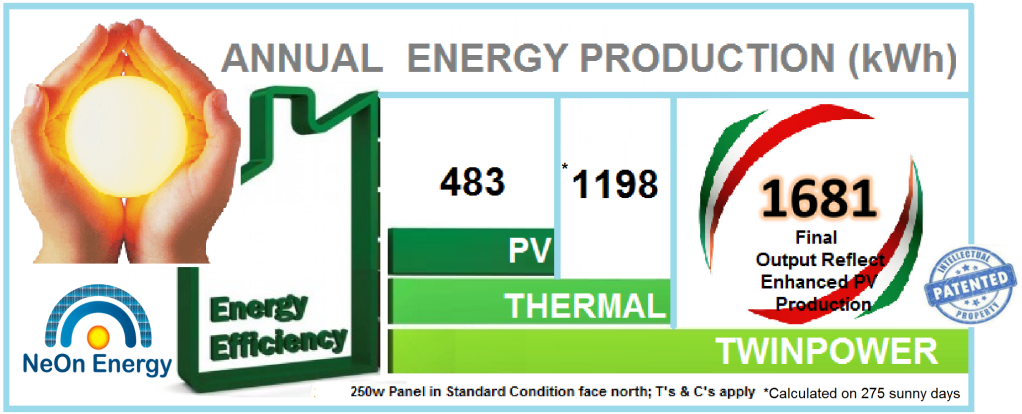
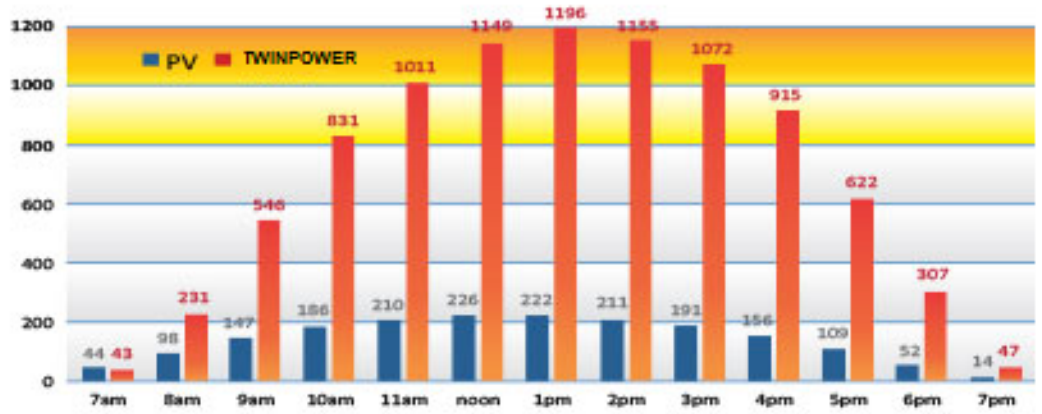
## WARRANTY PVT SYSTEM & PERFORMANCE

- Guarantee of 95% of the rated power for 10 years
- Guarantee of 87% of the rated power for 25 years;
- 12 years product warranty;
- Resistance to hailstones up to 35 mm at 90 km / h
- Resistance to wind up to 190 km / h
- Working temperature range -40°C / +125°C
- Water and glycol system
- Forced circulation or thermosiphon system



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InstallationYear:2011
Location: Cyprus
Test:2016

See The Video

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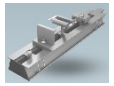
## Comparison of Installation for 10 kWp 60 kWh/day
## 300 Lt Boiler/Geyser/Water Heater 4.5kW element

### Traditional Photovoltaic Installation


No. 30 module for 330W each


Inverter 10 kW


Substructure for 30 module

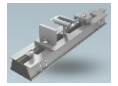

Solar Cable

### TWINPOWER Installation


No. 12 module for 330W each


No. 6 PVT module for 330W/*890w each
+ Pump + solar controller
*AT 1000w/SM IRRADIATION


Inverter 6 kW


Substructure for 18 module


Solar Cable

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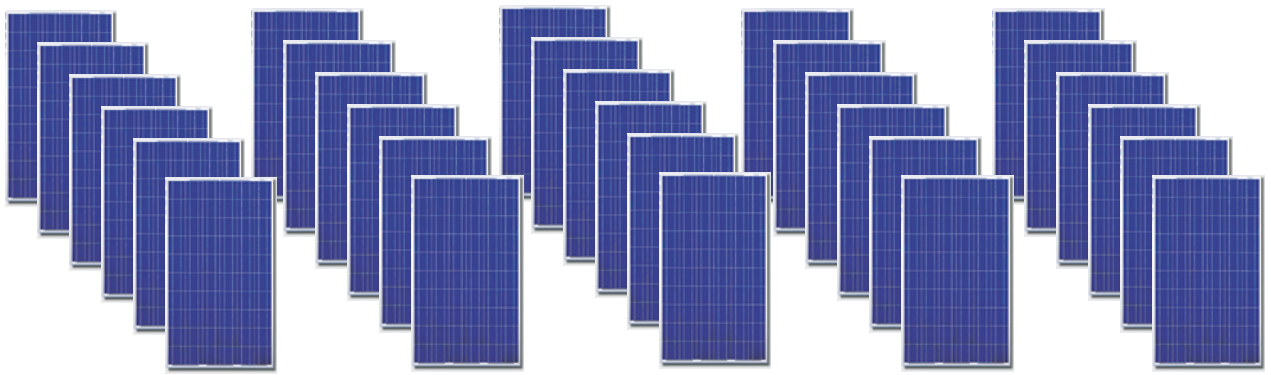
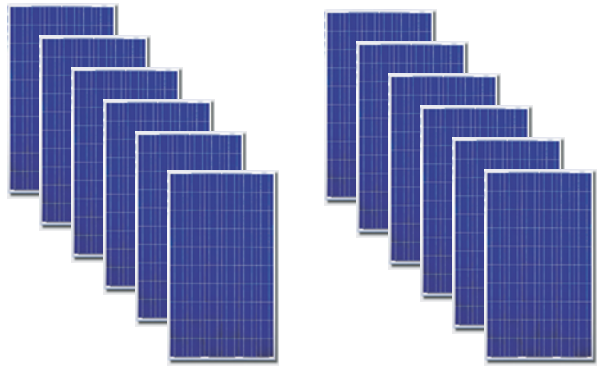
# TWINPOWER INSTALLATION IS 40% SMALLER OF THE CONVENTIONAL PV SYSTEM

**CONVENTIONAL PV INSTALLATION**
**30 PV**



| NORMAL PV SYSTEM | | | |
|---|---|---|---|
| **330** | **W** | | |
| N. | ITEM | kWp | TOTAL kWp |
| 30 | PV | 9,9 | 9,9 |



**TWINPOWER INSTALLATION**
**12 PV + 6 PVT**

| PVT TWINPOWER SYSTEM | | | |
|---|---|---|---|
| **330** | W | MORE ENERGY AVAILABLE | **44,44%** |
| **965** | W | | |
| N. | ITEM | kWp | TOTAL kWp |
| 12 | 18 PV | 8,51 | |
| 6 | PVT | 5,79 | **14,3** |
| PERFORMANCE OF THERMAL CALCULATE EVERAGE AT IRRADIATION 1280W PER SQ M | | | |

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# MINISTRY OF HOUSING PROJECT

- In 2018 MOH solar project was implemented
- The PV system installed on it costs about *10%* of the price of the villa
- The ROI 8.6 YEARS

| PV ONLY SYSTEM | PVT SYSTEM |
| --- | --- |
| ***ROI 8.6 YEARS*** | ***ROI 3.5 YEARS*** |

- With the PVT system..
- The ROI is greatly enhanced
- Due to extreme weather conditions a PV panel's life cycle continues to drop and the panel will lose most of its efficiency by 5 to 6 years
- *PVT guarantees 25 years of panel performance*

*Let's take a look at the case study for D11 design MOH villas..*

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ENERGY
TECHNOLOGY

وزارة الإسكان
Ministry of Housing

# CASE STUDY

الوحدة السكنية نمـــــوذج D11 :

- عدد الأدوار: 2
- عدد الغرف: 4
- المساحة البنائية: 240 متر²


الطابق الأرضي




الطابق الأول

D 11 model.
2 floors
4 bedroom
We will be looking at
2 different scenarios
for the installation
of the system

1) PV
2) PV+PVT

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وزارة الإسكان
Ministry of Housing

## HOUSE TYPE D11 GROUND FLOOR

**DB-GROUND FLOOR.** CABLE SIZE: 4C 25mm2 XLPE/SWA/PVC

BREAKING CAPACITY : 6 KA 230/400V 50Hz | TYPE : 4+4 WAY 100A TPN+E BUSBARS(FLUSH MOUNTED)

| CIRCUIT NO. | DESCRIPTIONS | LOAD IN WATTS R | Y | B | MCB RATING (Ampere) | WIRE SIZE ($mm^2$) |
|---|---|---|---|---|---|---|
| **LIGHTING SECTION** | ELCB RATING : 80A TPN 300 mA<br>BUS BAR RATING : 100A TP | | | | | |
| R1 | LIGHT + FAN + EX FAN (KITCHEN) | 400 | | | 10 | 1.5mm² |
| Y1 | LIGHT + FAN (MAID'S,FAM. & SHAFT) | | 500 | | 10 | 1.5mm² |
| B1 | LIGHT + FAN (BATH 1, STORE, MAJLIS & STAIRS) | | | 900 | 10 | 1.5mm² |
| R2 | LIGHT (EXTERNAL & GARAGE) | 800 | | | 10 | 1.5mm² |
| Y2 | WINDOW A/C (MAID'S,FAM. & SHAFT) | | 2500 | | 32 | 6.0mm² |
| B2 | SPLIT A/C (MAJLIS) | | | 2500 | 32 | 6.0mm² |
| R3 | SPLIT A/C (FAMILY HALL) | 2500 | | | 32 | 6.0mm² |
| Y3 | SPARE | | | | | |
| B3 | SPARE | | | | | |
| R4 | SPARE | | | | | |
| Y4 | SPARE | | | | | |
| B4 | SPARE | | | | | |
| | | | | | | |
| **POWER SECTION** | ELCB RATING : 80A TPN 300 mA<br>BUS BAR RATING : 100A TP | | | | | |
| R5 | SOCKET (KITCHEN) 4 NOS. | 1600 | | | 32 | 2.5mm² |
| Y5 | W/MACHINE OUTLET (KITCHEN) 1 NO. | | 400 | | 32 | 2.5mm² |
| B5 | SOCKET (FAM. HALL & MAID'S) 7 NOS. | | | 2800 | 32 | 2.5mm² |
| R6 | SOCKET (MAJLIS & GARAGE) 7 NOS. | 2800 | | | 32 | 2.5mm² |
| Y6 | WATER HEATER | | 1500 | | 20 | 2.5mm² |
| B6 | WATER PUMP | | | 1000 | 32 | 2.5mm |
| R7 | SPARE | | | | | |
| Y7 | SPARE | | | | | |
| B7 | SPARE | | | | | |
| R8 | SPARE | | | | | |
| Y8 | SPARE | | | | | |
| B8 | SPARE | | | | | |
| | | | | | | |
| | TOTAL LOAD PER PHASE | 8100 | 4900 | 7200 | | |

MAIN SUPPLY TYPE : MCCP
RATING : 100 TPN
TOTAL LOAD 3 Ø = 35700

GROUND FLOOR LOAD = 20.2 KW.
FIRST FLOOR LOAD = 25.6 KW
TOTAL LOAD = 45.8 KW.

## HOUSE TYPE D11 FIRST FLOOR

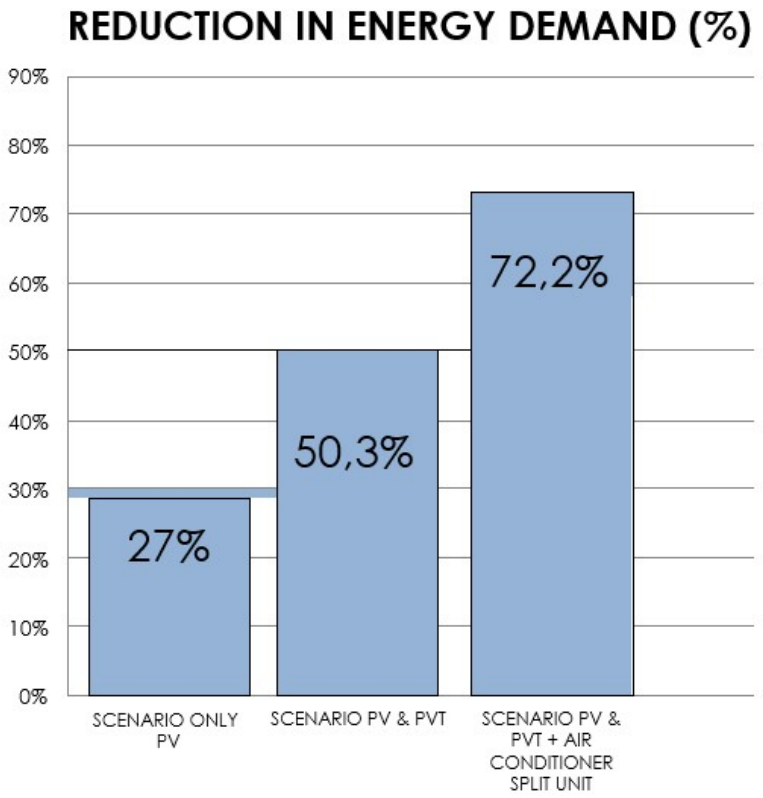
**DB-FIRST FLOOR** CABLE SIZES 4C 16mm2 XLPE/SWA/PVC

BREAKING CAPACITY : 6 KA 230/400V 50Hz | TYPE : 4+4 WAY 100A TPN+E BUSBARS(FLUSH MOUNTED)

| CIRCUIT NO. | DESCRIPTIONS | LOAD IN WATTS R | Y | B | MCB RATING (Ampere) | WIRE SIZE ($mm^2$) |
|---|---|---|---|---|---|---|
| | ELCB RATING : 80A TPN 300 mA | | | | | |
| **LIGHTING SECTION** | BUS BAR RATING : 100A TP | | | | | |
| R1 | LIGHT + FAN (LOBBY, BATH 3 4) | 700 | | | 10 | 1.5mm² |
| Y1 | LIGHT + FAN (BEDROOM 1& 2) | | 600 | | 10 | 1.5mm² |
| B1 | LIGHT + FAN (BED ROOM 3 + BATH) | | | 800 | 10 | 1.5mm² |
| R2 | LIGHT + FAN (M.BED ROOM + BATH) | 800 | | | | |
| Y2 | SPLIT A/C (BEDROOM-1) | | 2500 | | 10 | 6mm² |
| B2 | SPLIT A/C (MASTER BEDROOM) | | | 2500 | 10 | 6mm² |
| R3 | SPLIT A/C (BEDROOM-2) | 2500 | | | 10 | 6mm² |
| Y3 | SPLIT A/C (BEDROOM-3) | | 2500 | | 30 | 6mm² |
| B3 | SPLIT A/C (LOBBY) | | | 2500 | 30 | 6mm² |
| R4 | SPARE | | | | | |
| Y4 | SPARE | | | | | |
| B4 | SPARE | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| **POWER SECTION** | ELCB RATING : 80A TPN 30 mA<br>BUS BAR RATING : 100A TP | | | | | |
| | | | | | | |
| R5 | SOCKET (BEDRM 1& LOBBY) 5 NOS. | 2000 | | | 20 | 2.5mm² |
| Y5 | SOCKET (BEDRM 2 & 3) 4 NOS. | | 3200 | | 20 | 2.5mm² |
| B5 | SOCKET (MASTER BEDRM) 5 NOS. | | | 2000 | 20 | |
| R6 | WATER HEATER | 1500 | | | 30 | 2.5mm² |
| Y6 | WATER HEATER | | 1500 | | 30 | 2.5mm² |
| B6 | SPARE | | | | | |
| R7 | SPARE | | | | | |
| Y7 | SPARE | | | | | |
| B7 | SPARE | | | | | |
| R8 | SPARE | | | | | |
| Y8 | SPARE | | | | | |
| B8 | SPARE | | | | | |
| | TOTAL LOAD PER PHASE | 7500 | 10300 | 7800 | | |
| | TOTAL LOAD = 25.6 KW. | | | | | |

MAIN SUPPLY TYPE : MCCP
RATING : 100 TPN

# ELECTRICAL LOAD DETAILS



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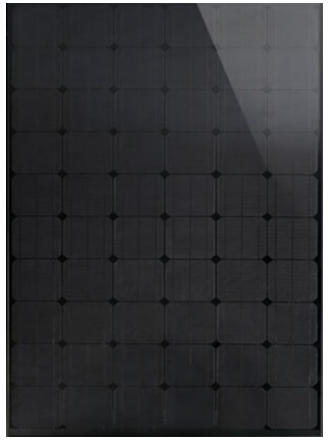
# CASE STUDY

**Scenario PV only**



PV

TOTAL KWh/day : **74.4**

**27% Load Covered**

**ROI 5 YEARS**

AVERAGE SAVING/3000 VILLAS per YEAR

***BHD 2,370,000/Year***

| No of units | ITEM | Cost | Total | | KW | KWh | Years | Years | Years | Years | Years |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | **PV** panels | BHD 65 | BHD 2600 | | 12.4 | 74.4 | 5 | 10 | 20 | 25 | 30 |
| 1 | INVERTER 12.5 KW | BHD 509 | BHD 509 | | **% load covered** | | KWh | KWh | KWh | KWh | KWh |
| 30 | SUBSTRUCTURE | BHD 25.89 | BHD 776.7 | | 27% | | 135,780 | 271,560 | 543,120 | 678,900 | 814,680 |
| 50 | CABLING | BHD 0.37 | BHD 18.30 | | | | | | | | |
| | | | BHD 3,904 | | AVG savings/year | | BHD 784,808 | BHD 820,125 | BHD 857,030 | BHD 895,597 | BHD 935,899 |
| INSTALLATION COST FOR KWh | | | BHD 52.47 | | AVG SAVING/3000 | | | | | | |
| INSTALLATION COST FOR KW | | | BHD 314.84 | | UNIT PER YEAR | | **BHD 2,370,000** | | **ROI YEARS** | **5** | |

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# CASE STUDY

## Scenario PV + PVT

PV+PVT
TOTAL KWh/day : **129.16**
**50.3% Load Covered**
**ROI 3.62 YEARS**

AVERAGE SAVING/3000 VILLAS per YEAR
***BHD 4,113,420/year***

| No of units | ITEM | Cost | Total |
|---|---|---|---|
| 40 | **PV panels** | BHD 65 | BHD 2600 |
| 12 | **PVT conversion** | BHD 32 | BHD 384 |
| 1 | INVERTER 12.5 KW | BHD 509 | BHD 509 |
| 40 | SUBSTRUCTURE | BHD 25.89 | BHD 1,035.6 |
| 50 | CABLING | BHD 0.37 | BHD 18.30 |
| 1 | PUMP | BHD 91.55 | BHD 91.55 |
| 1 | SOLAR CONTROL | BHD 75 | BHD 75 |
| 2 | **ARISTON DUNE FS 40 GALLON** | BHD 85.686 | BHD 171.372 |
| 40 | PIPE + FITTING | BHD 1.17 | BHD 46.80 |
| | | | BHD 4,931.622 |
| INSTALLATION COST FOR KWh | | | BHD 38.18 |
| INSTALLATION COST FOR KW | | | BHD 213.675 |

| KW | KWh |
|---|---|
| 12.4 | 74.4 |
| 10.68 | 48.06 |

KWh increased performance from PVT

**6.696**

% load covered

**50.30%**

**Total Kwh**

**129.16**

| | Years | Years | Years | Years | Years |
|---|---|---|---|---|---|
| | 5 | 10 | 20 | 25 | 30 |
| | KWh | KWh | KWh | KWh | KWh |
| | 235,710 | 471,419 | 942,839 | 1,178,549 | 1,414,258 |
| AVG savings/year | BHD 1,362.40 | BHD 1,423.71 | BHD 1,487.78 | BHD 1,554.73 | BHD 1,624.69 |
| AVG SAVING/3000 UNIT PER YEAR | **BHD 4,113,420.0** | | **ROI YEARS** | **3.62** | |

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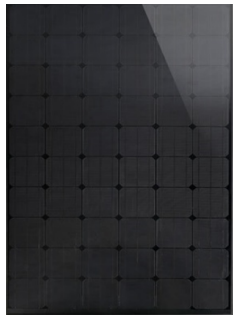
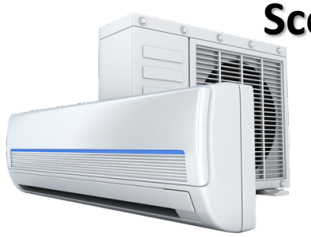
# CASE STUDY

## Scenario PV + PVT + Air conditioner





PV + PVT+ Air Conditioner
TOTAL KWh/day : **129.16**
**72.2% Load Covered**
**ROI 5.57 YEARS**

AVERAGE SAVING/3000 VILLAS per YEAR
***BHD 4,113,420/year***

| No of units | ITEM | Cost | Total | | KW | KWh | Years | Years | Years | Years | Years |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | **PV panels** | BHD 65 | BHD 2600 | | 12.4 | 74.4 | 5 | 10 | 20 | 25 | 30 |
| 12 | **PVT conversion** | BHD 32 | BHD 384 | | 10.68 | 48.06 | | | | | |
| 1 | INVERTER 12.5 KW | BHD 509 | BHD 509 | | KWh increased performance from PVT | | KWh | KWh | KWh | KWh | KWh |
| 40 | SUBSTRUCTURE | BHD 25.89 | BHD 1,035.6 | | | | 235,710 | 471,419 | 942,839 | 1,178,549 | 1,414,258 |
| 50 | CABLING | BHD 0.37 | BHD 18.30 | | **6.696** | | | | | | |
| 1 | PUMP | BHD 91.55 | BHD 91.55 | | % load covered | | | | | | |
| 1 | SOLAR CONTROL | BHD 75 | BHD 75 | | **72.20%** | | | | | | |
| 2 | **ARISTON DUNE FS 40 GALLON** | BHD 85.686 | BHD 171.372 | | **Total Kwh** | | | | | | |
| 40 | PIPE + FITTING | BHD 1.17 | BHD 46.80 | | **129.16** | | | | | | |
| 8 | **SPLIT UNITS** | BHD 324 | BHD 2,592 | | **KW** | ***20** | Only 50% load is considered in the calculation of savings | | | | |
| | | | BHD 7523.622 | | AVG savings/year | | BHD 1,362.40 | BHD 1,423.71 | BHD 1,487.78 | BHD 1,554.73 | BHD 1,624.69 |
| INSTALLATION COST FOR KWh | | | BHD 58.25 | | AVG SAVING/3000 | | | | | | |
| INSTALLATION COST FOR KW | | | BHD 326 | | UNIT PER YEAR | | **BHD 4,113,420.0** | | **ROI YEARS** | **5.57** | |

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# IMPACT ON THE ENVIRONMENT for 3000 units in 30 years

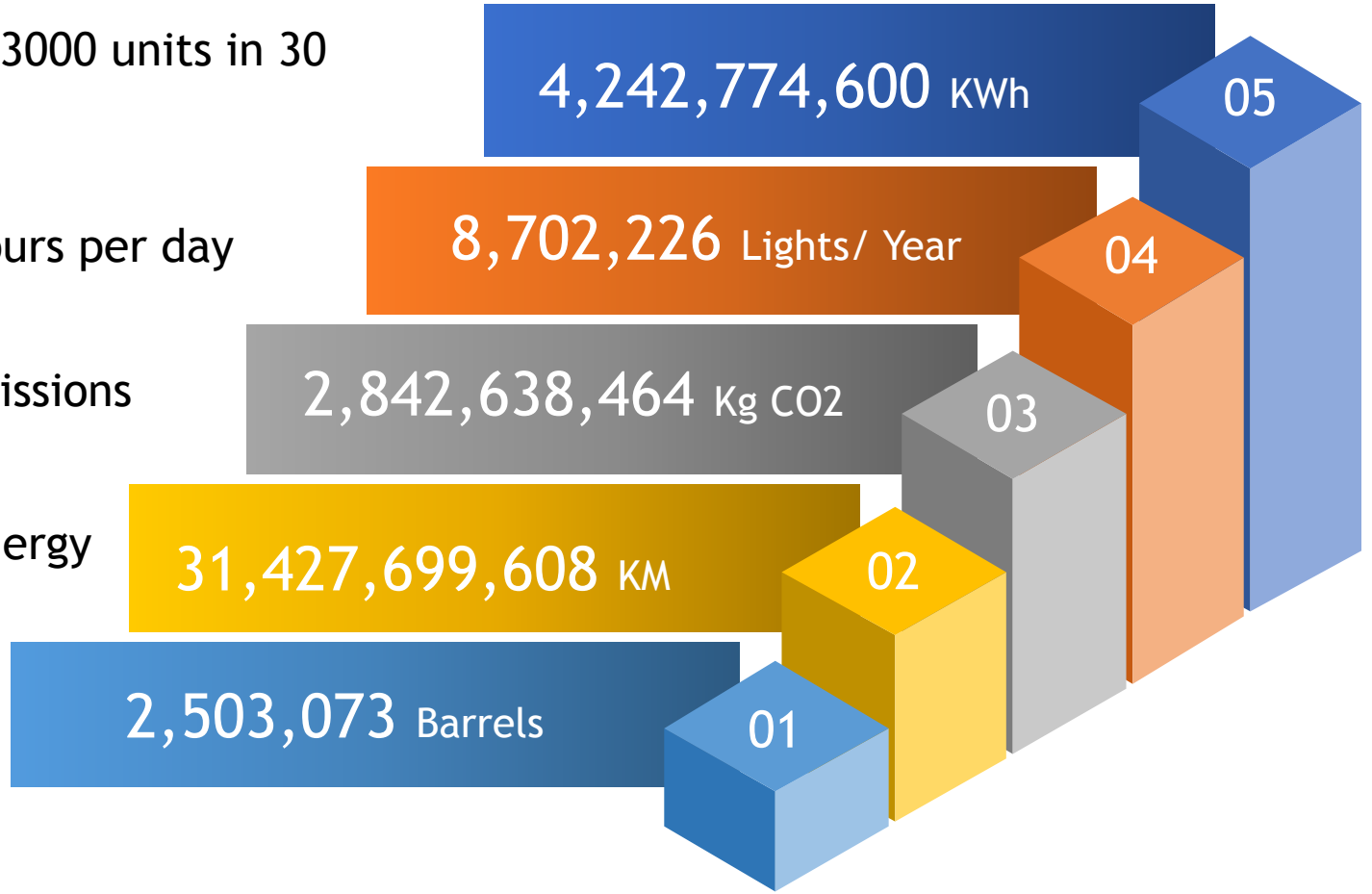
Total reduction in energy demand for 3000 units in 30 years using TWIN POWER system

Total lighting points operating 4 hours per day

Avoided CO2 emissions

Electric car mileage thanks to the energy generated

Barrels of oil saved



ART AND RENEWABLE ENERGY TECHNOLOGY

# CASE STUDY FOR HOTEL APPARTMENTS BUILDING

## Scenario PV

- Connected Load For Cooling & Heating Systems 582 KWp
- Total Number of PV Panels 1766
- Required area for the PV installation 3600 m2
- Generated Power 3124 KWh /day
- Project Cost 2,370,000 Dhs.
- Cooling & Heating Equipment's Cost 800,000 Dhs.
- Total Saving Per Day 1,240 Dhs.
- Total Saving Per Year 452,000 Dhs.
- R.O.I 7 Years.

## Scenario PV + PVT + Absorption Chiller

- Connected Load For Cooling & Heating Systems 582 KWp
- Total Number of PVT Panels 322 + 120 Evacuated Tubes sets
- Required area for the system installation 1600 m2
- Generated Power 637 KWh /day Electricity +3200 KWh Thermal
- Project Cost including Chiller 3,840,000 Dhs.
- Total Saving Per Day 254 Dhs. Elect + 2,100 Dhs Cooling cost + 280 Dhs Heating cost.
- Total Saving Per Year 961,400 Dhs.
- R.O.I 4 Years.