



מוסד שמואל נאמן  
למחקר מדיניות לאומית

בטריות ליתיום איון פוספט אגירת אנרגיה ל  
25 שנה מהשמש 6000-10000 מחזורי  
פריקה טעינה המהפכה הבאה בשוק האנרגיה  
העולמי : רכבים בתים ותחנות-כח

Eng. Ami Elazari MBA

Main (HQ) Namir 179 po box 48466 OFFICE -Ranana hasadna 07

Millennium - Factory ISRAEL Maale Edomim 8 OEM CHINA

# PART 1 ECONOMIC OF PV & BESS

# RENEWABLE ALTERNATIVE ENERGY IS CHEAPER THAN ANY SOURCE OF ENERGY TODAY

מחיר יצור החשמל בטכנולוגיה פוטוולטאית לבד 3-4 סנט לקוטש עם בנק בטריות ותעוז 3 סנט ופחות

JP MORGAN & BLUMBERG

## Unsubsidized Levelized Cost of Energy Comparison



Sources: Lazard's Levelized Cost of Storage Analysis JP Morgan; Bloomberg New Energy Finance; Bain analysis

Levelized Cost (\$/MWh)

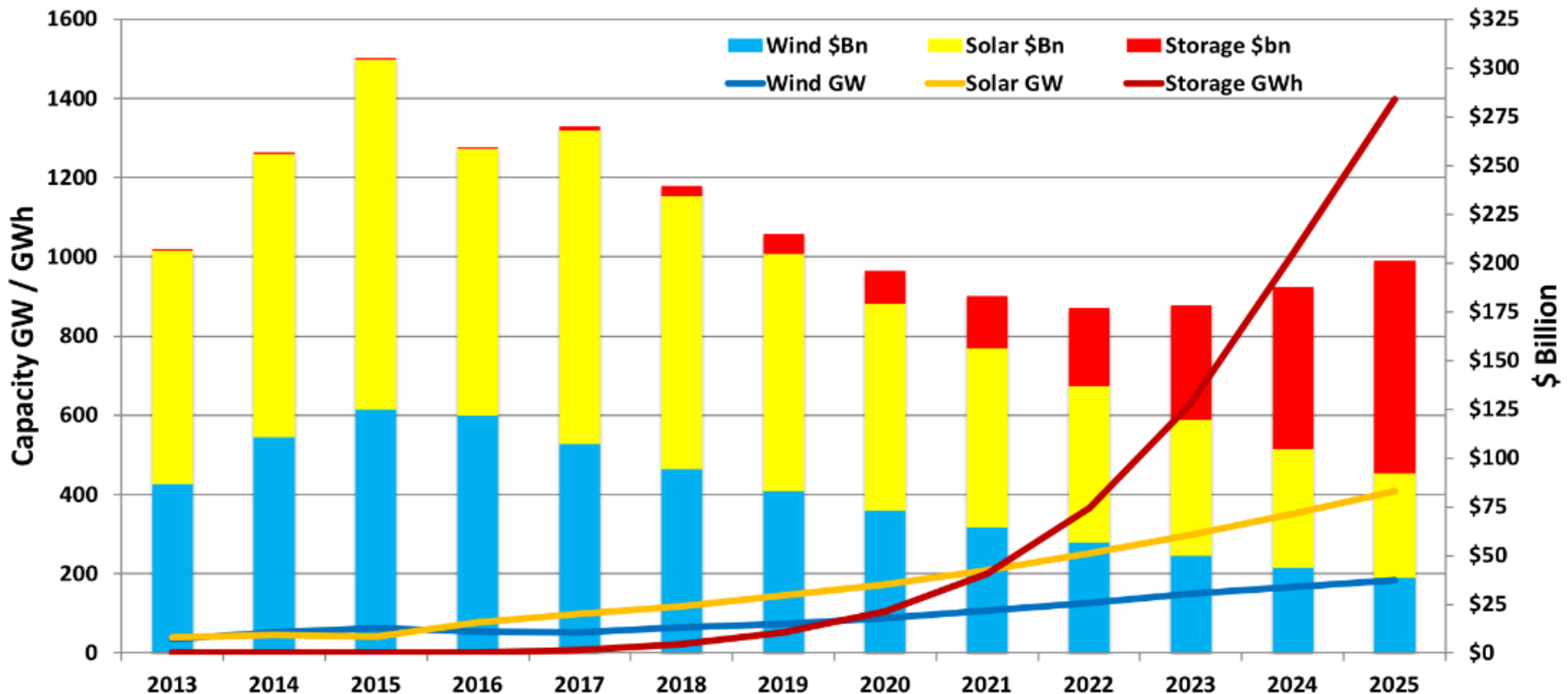
# BATTERY STORAGE FUTURE

מהפכת האנרגיה מ2018 בטריות ליתיום

פוספט

## Global wind, solar and storage - annual spend and annual capacity additions

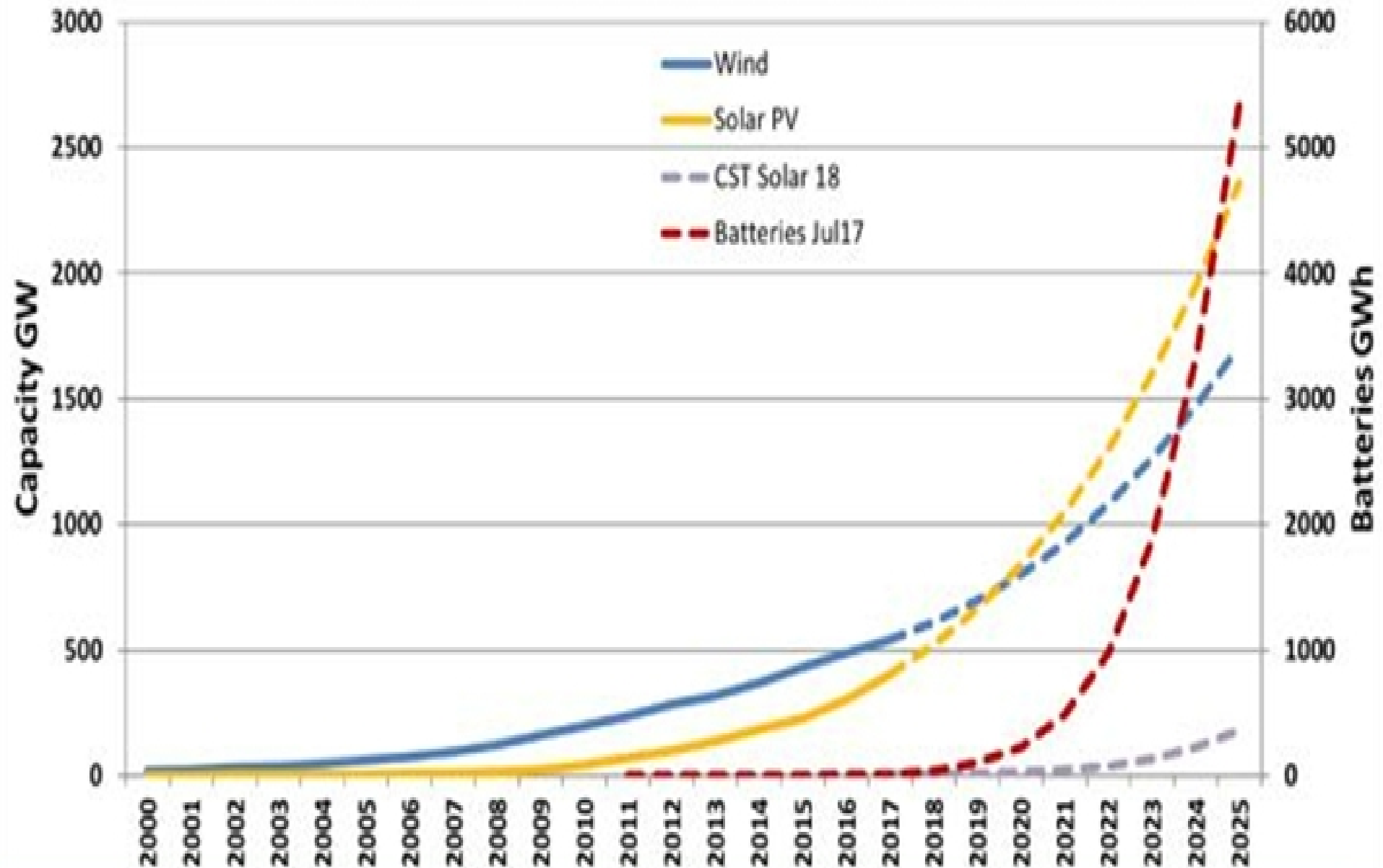
Wind, PV GW & storage GWh lines; \$ columns Data FS UNEP 2013-2017 Projection 2018+ @FSS\_Au @ProfRayWills 30Jun18





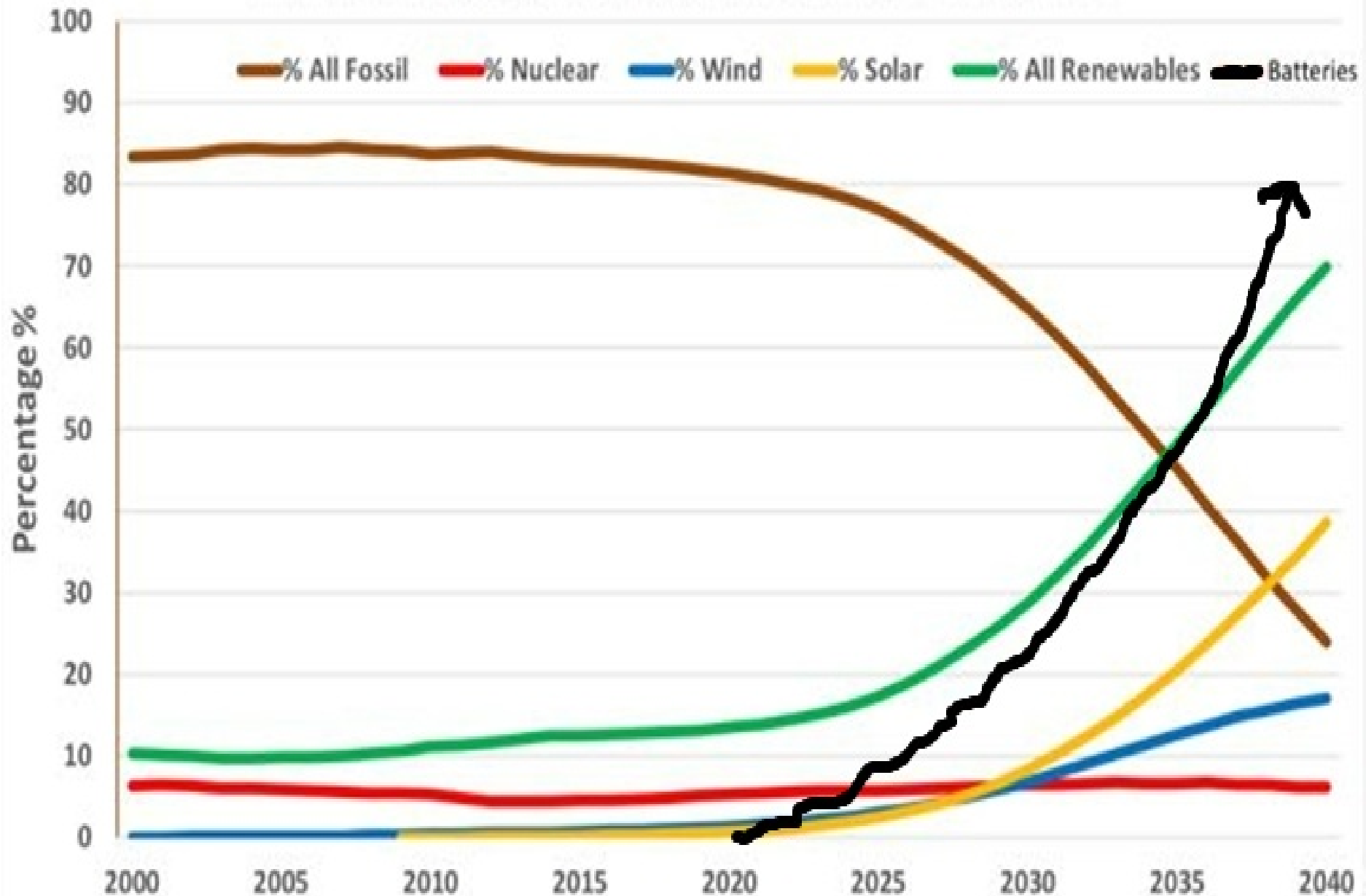
# Global renewables capacity 2000-2017 and projection to 2025

wind, PV, CST (GW) battery (GWh) actual; 2017 on projection @FSS\_Au @ProfRayWills 24Feb18



# World primary energy consumption % share by fuel category, 2000-2040

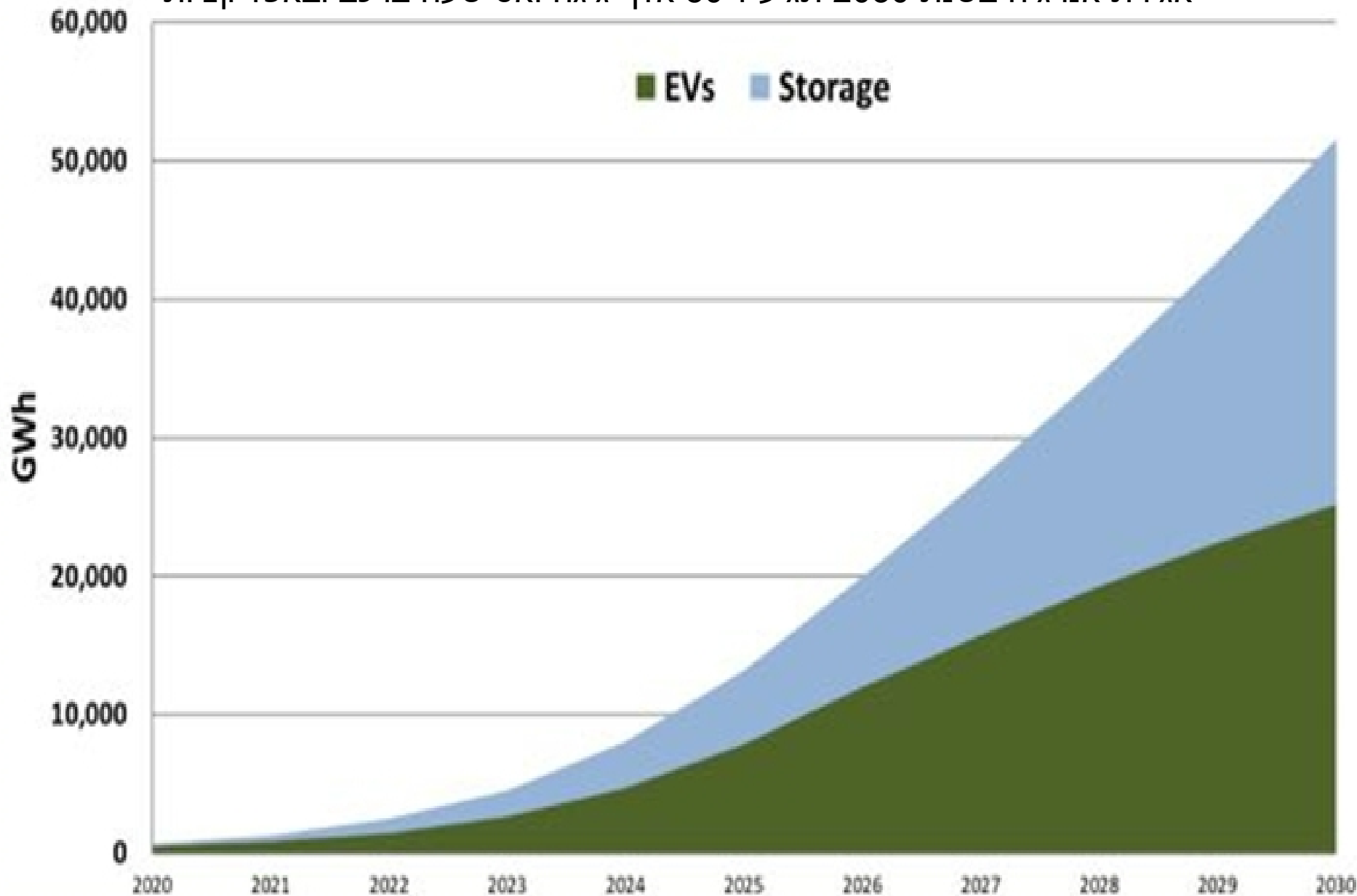
US EIA data 1990-2016 Chart and Projections @FSS\_Au @ProfRayWills Update 24Feb18



# Cumulative global electric vehicle and stationary storage GWh 2020 to 2030

Chart and projection @FSS\_Au @ProfRayWills 3Mar18 <http://www.raywills.net/rtwtechadopt.html>

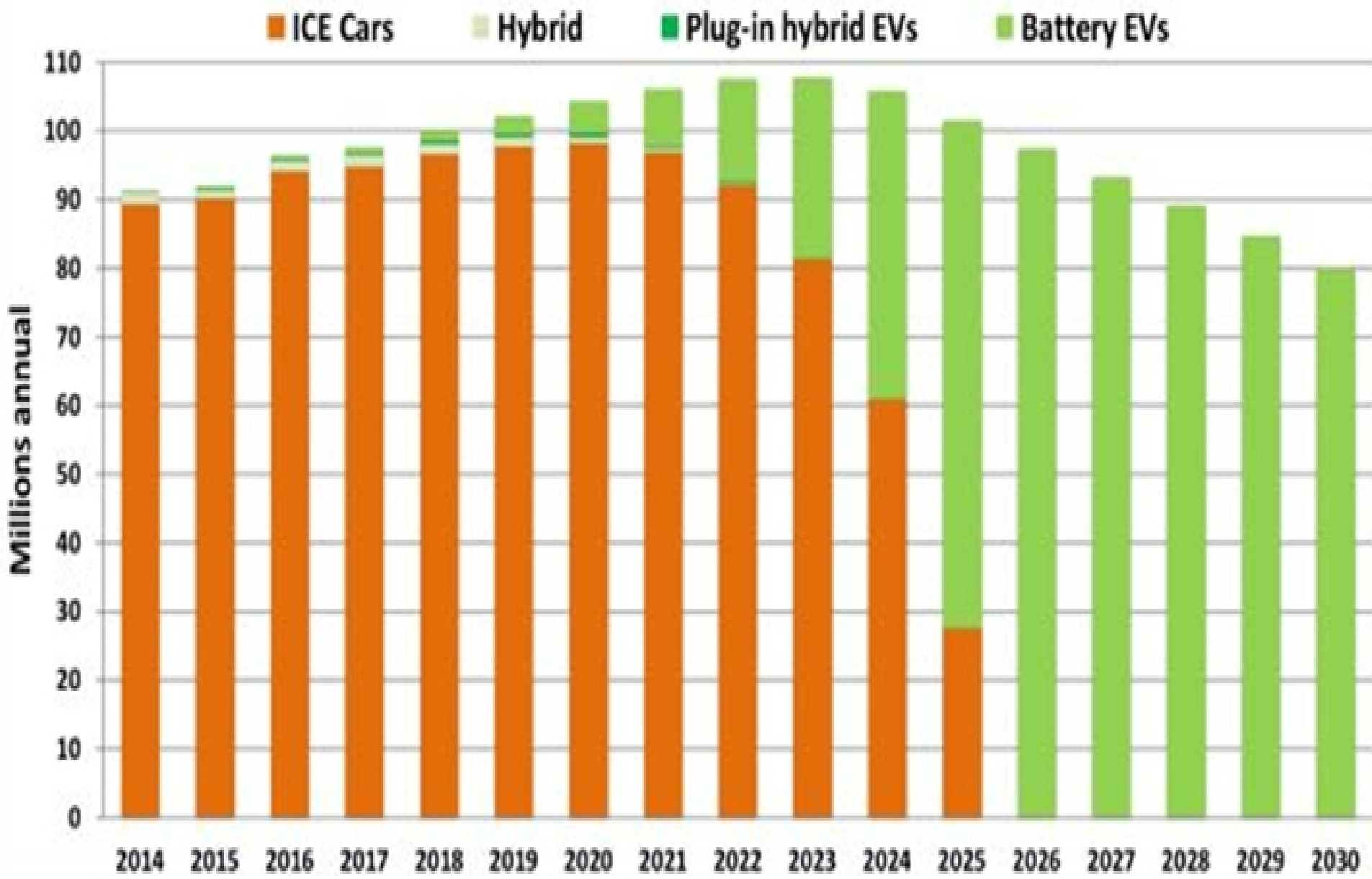
אגירת אנרגיה בשנת 2030 תגיע ל 50 אלף גיגה ואט שעה ברכב ובאפליקציות



## Transition to electric vehicles - global vehicle annual sales to 2017 projected to 2030

Car data OICA; EV data 2014-2017 @InsideEVs & @IEA Chart & projection @FSS\_Au @ProfRayWills updated 3Mar18

משנת 2026 יסעו בכבישים רק רכבים חשמליים כחלק ממהפכת האנרגיה

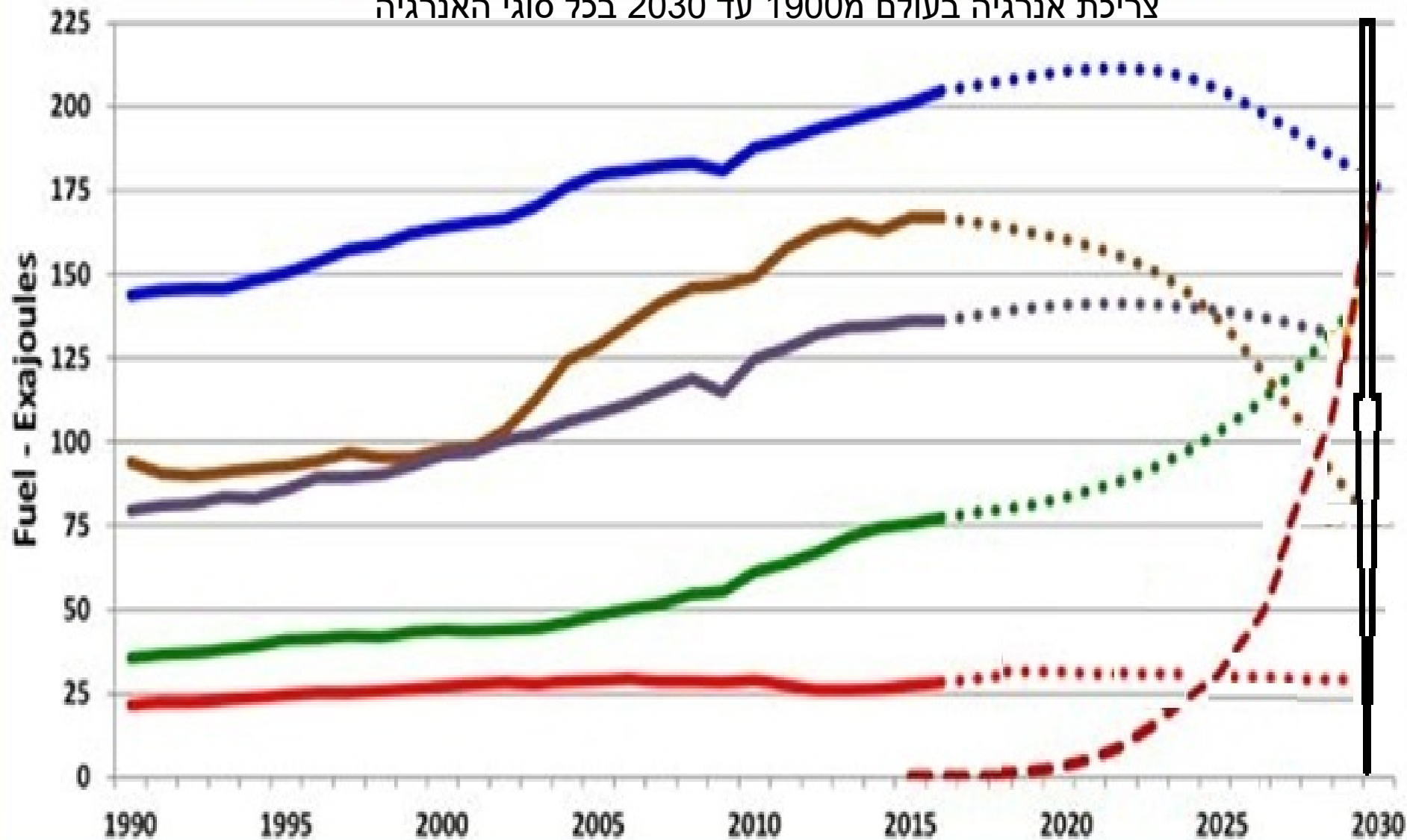


# World energy consumption by fuel type, 1990-2030

US EIA data 1990-2016 @FSS\_Au @ProfRayWills projections incl. energy efficiency gains, battery use. Update 24Feb18

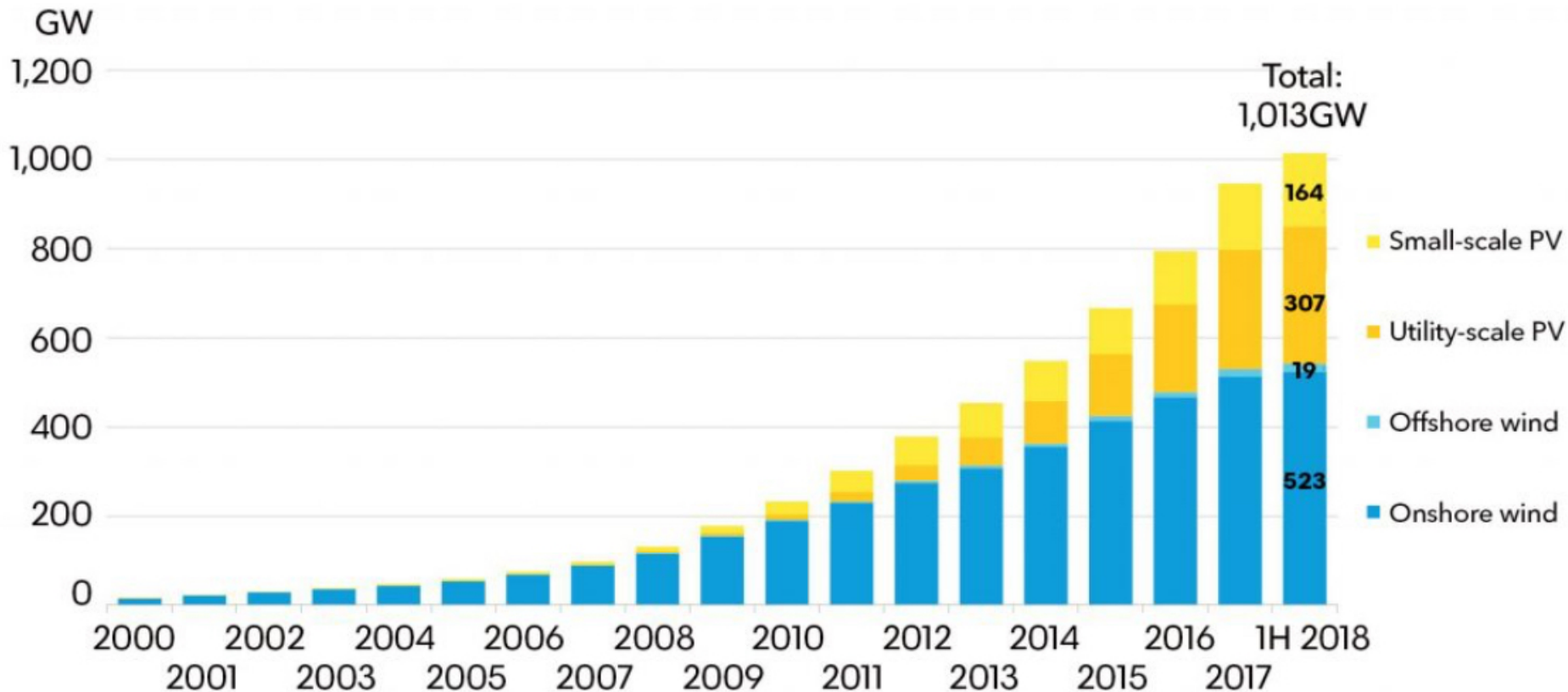
Oil Coal Natural Gas Renewables Nuclear Batteries 2018

צריכת אנרגיה בעולם מ 1900 עד 2030 בכל סוגי האנרגיה



# WIND \_SOLAR INSTALLATION

Global wind and solar installations, cumulative to June 30, 2018

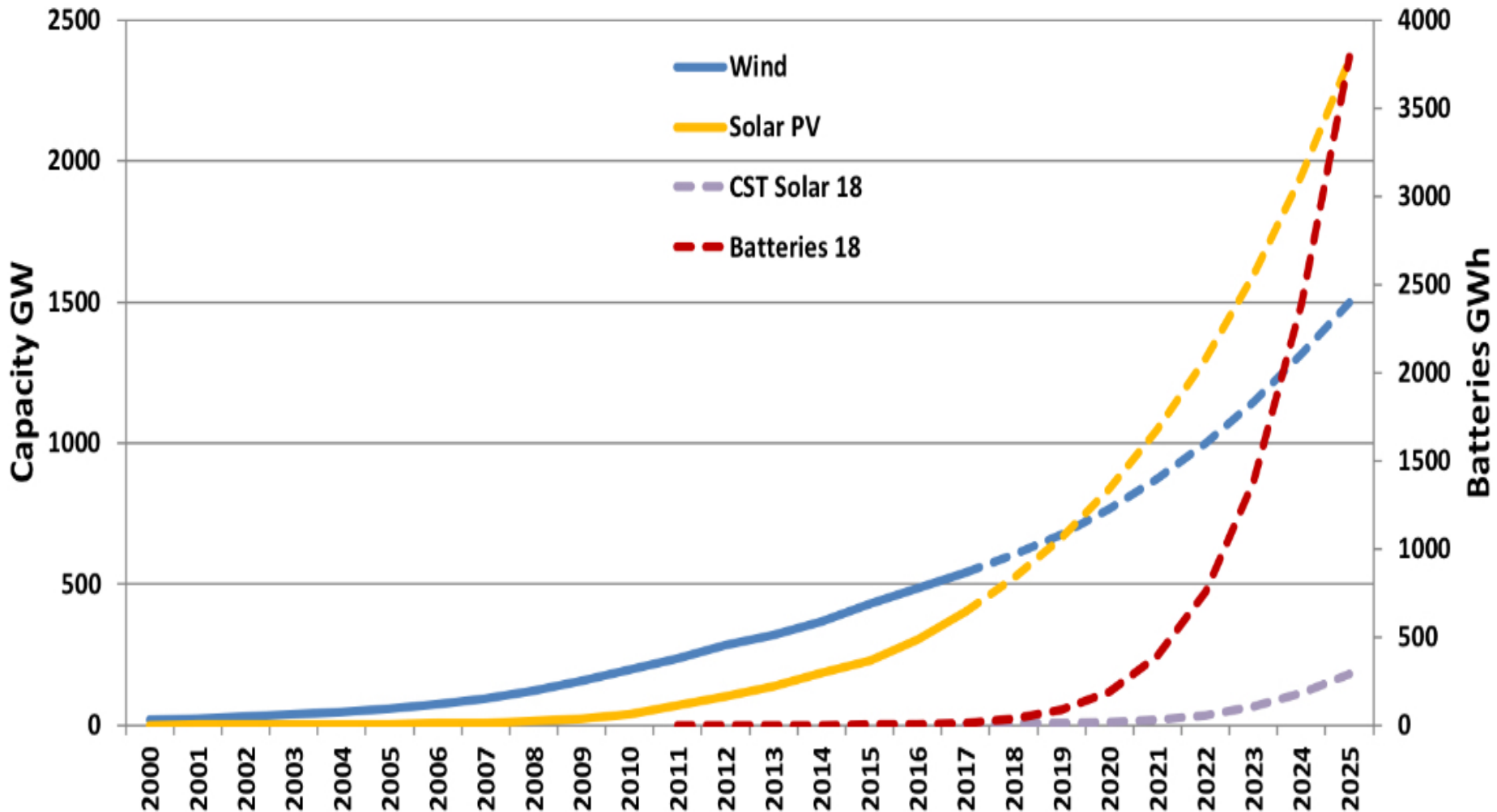


Source: Bloomberg NEF. Note: 1H 2018 figures for onshore wind are based on a conservative estimate; the true figure will be higher. BNEF typically does not publish mid-year installation numbers.

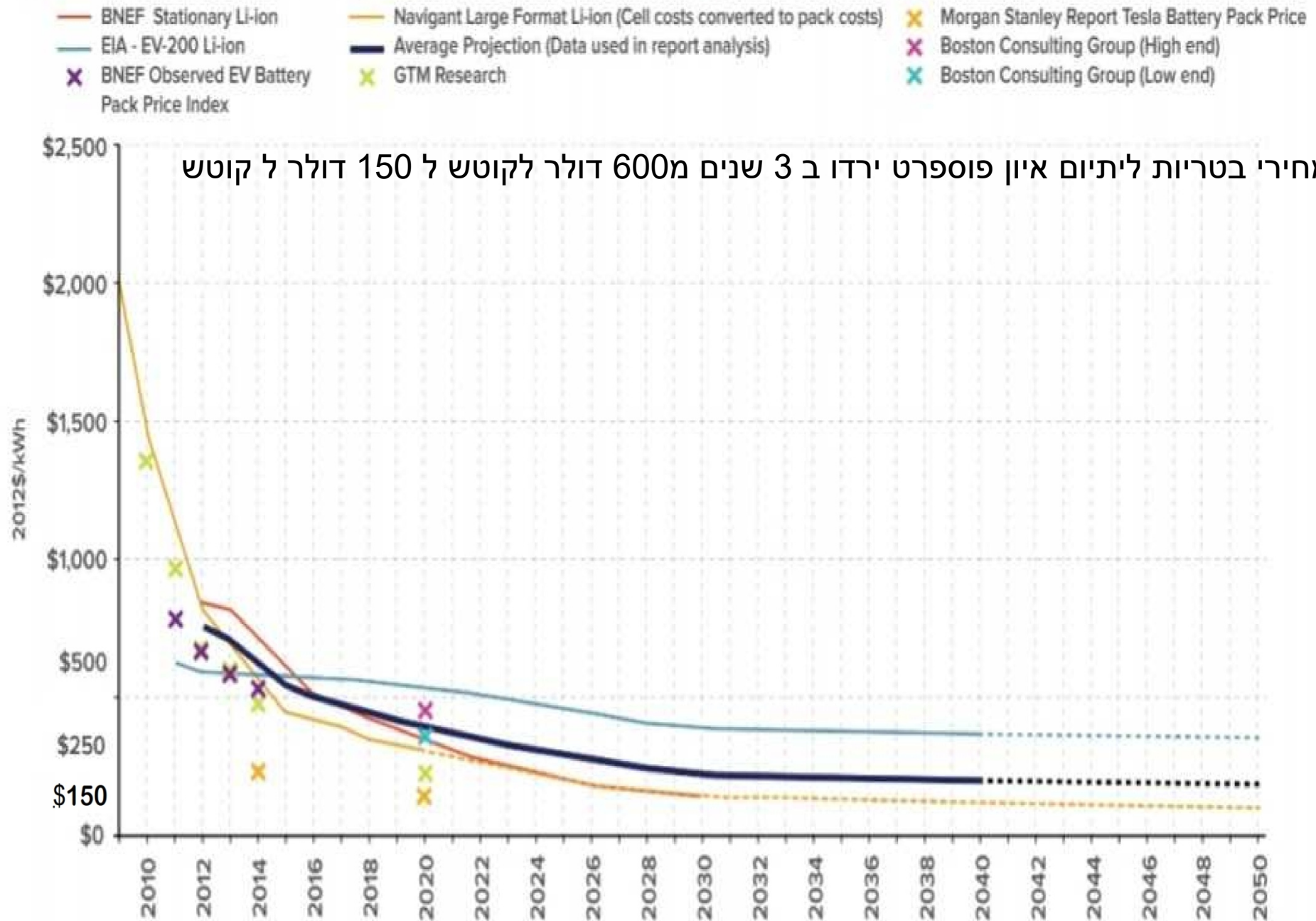
# BATTERY FUTURE VS PV\_WIND

## Global renewables cumulative capacity growth & projection to 2000-2025

Solid lines - wind, PV, CST (GW) battery (GWh) actual; Projection - dashed @FSS\_Au @ProfRayWills 4May18



**Figure 2. Lithium-Ion Battery Prices Have Declined Sharply and Are Expected To Continue Declining**





**Figure 3: Grid payback times and power costs with \$600/kWh and \$300/kWh \$150/kWh Lithium-Ion Battery**

Payback time is 6 years for \$600/kwh and Less than 5 years for \$300/kwh  
 Payback time 3 years for \$150/Kwh Today Oct. 2018 price

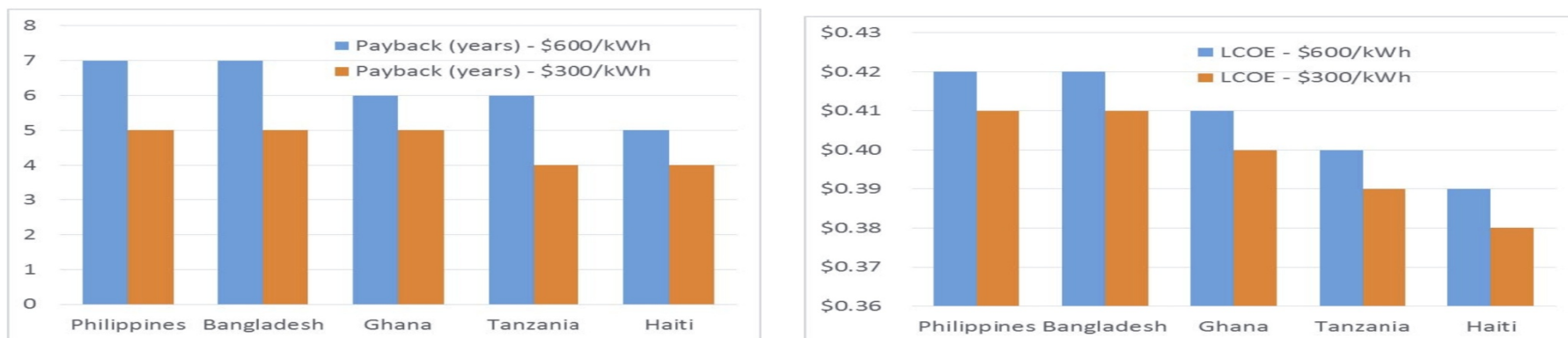


Figure 3 illustrates micro-grid electricity cost results from five selected countries. Key assumptions include a 30 kWh lithium-ion battery bank with a capital cost of \$600/kWh and a 20kW photovoltaic & battery installation at \$3.00/W. As shown, payback periods range from five to seven years (compared to being powered with only diesel generation). LCOE is levelized cost of energy

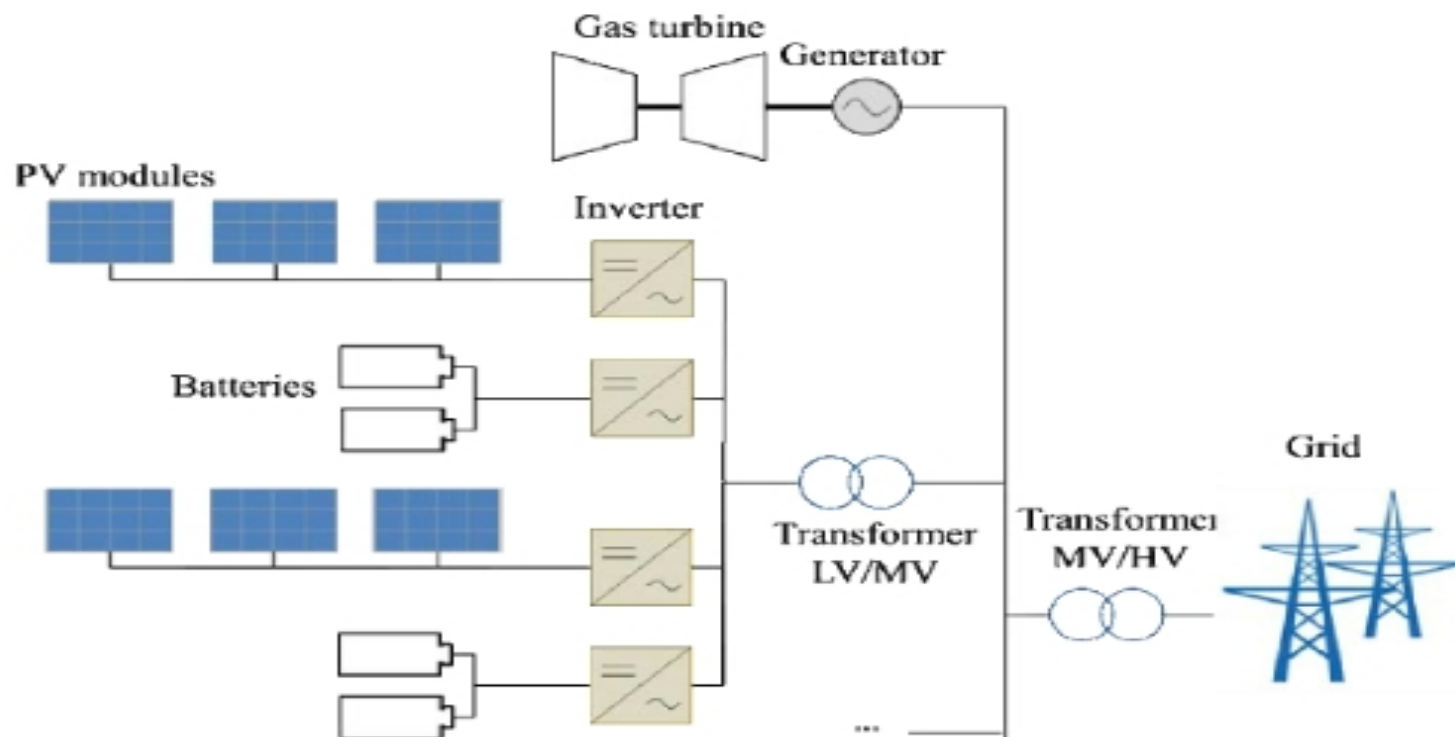
לפי הבנק העולמי מחיר הבטריות לאגירה ירדו ל 150 דולר ל קוטש ב 2018

School

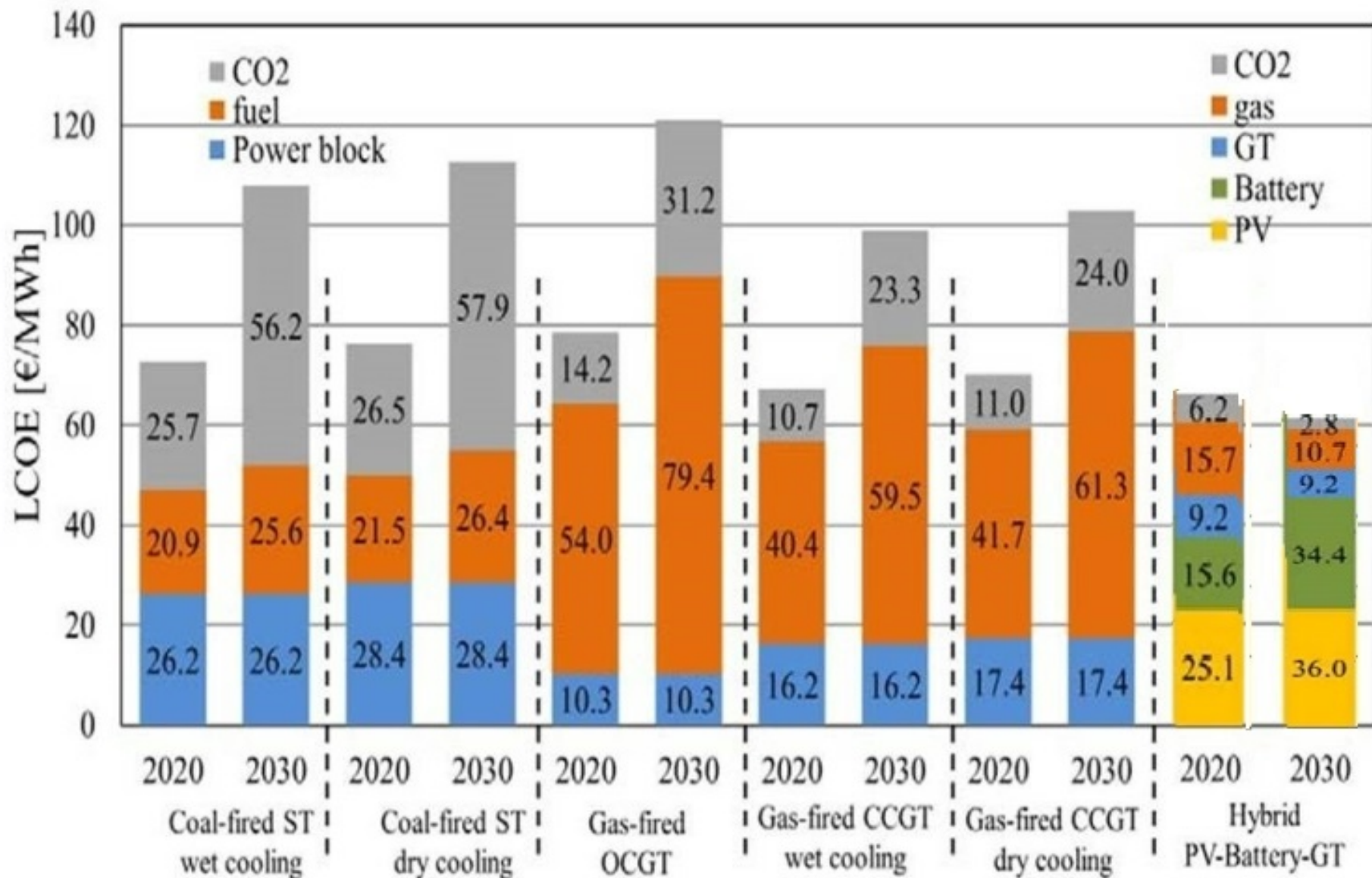
# מודל משולב תחנה פטוולטאית בנק בטורבינת גז מחובר רשת ותעוז

## 2.2. Modeling of hybrid PV-Battery-GT plant

The nominal capacity of the considered power plant is 100 MW AC. A standard PV system layout is assumed as shown in Fig. 5. A modular design approach is considered. It has shown to be a successful industrial solution, since it gives greater flexibility in designing the power plant. The plant is divided into ten independent medium voltage sectors. Each sector has five 2000 kVA low voltage to medium voltage (LV/MV) transformers. To every transformer two 1000 kW inverters with a corresponding array of PV modules are connected. To decrease the LCOE of the plant, a DC overdimensioning factor of around 140% is chosen. This means a PV unit of 1408 kW<sub>p</sub> is installed for every 1000 kW inverter unit, or 2816 kW<sub>p</sub> for every standard block. PV modules and batteries are coupled on the AC side. It is assumed that two battery blocks of 3000 kWh with a C-rate (which is the rate at which the battery is discharged with a specified continuous current) of 0.33 are installed to each inverter, resulting in a discharge time of six hours. Additionally, two 50 MW GT are chosen for backup.



# מקנזי תחזית מודל משולב בטריה פוטוולאית וגז ל שנת 2030

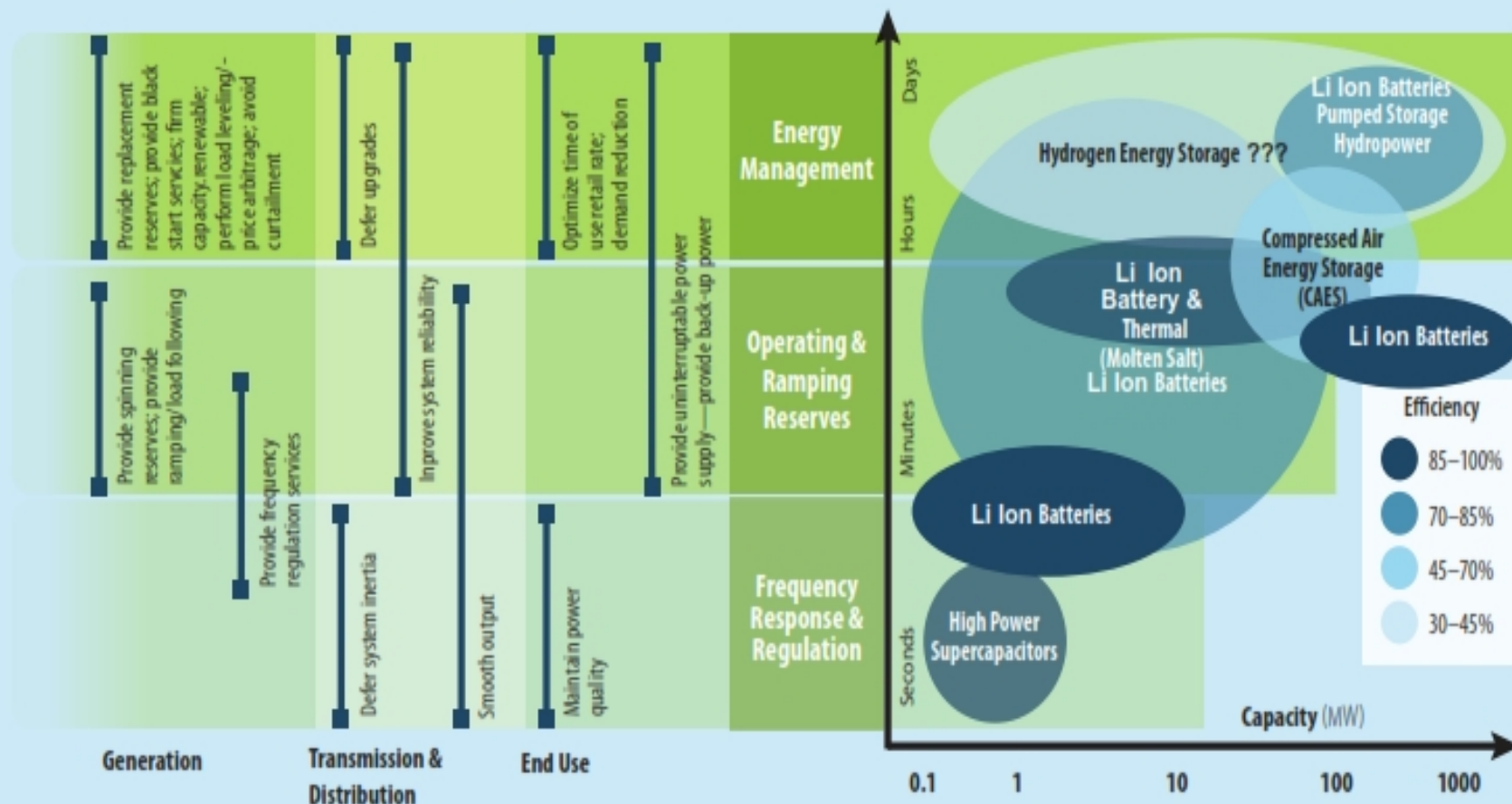




## POTENTIAL GRID APPLICATIONS



## STORAGE TECHNOLOGY CHARACTERISTICS



**Figure 1.** “Storage” is a broad category of technologies and applications that can help utilities balance power supply and demand by holding energy for later use, like a bank account for energy. Storage technologies are distinguished primarily by capacity and discharge time. Different storage technologies can be used for each of three main electric sector goals: energy management for daily/hourly scheduling, operating and ramping reserves for load following, and frequency response and regulation to maintain power quality.



# Economic Analysis Case Studies of Battery Energy Storage with SAM

Nicholas DiOrio, Aron Dobos, and Steven Janzou  
 National Renewable Energy Laboratory

Prepared under Task No. SS139001

## 2.4.1 Lithium-Ion

Daily-cycle lithium-ion nickel manganese cobalt oxide (NMC) batteries similar to the Tesla Powerwall batteries were selected for the lithium-ion battery bank. Table 3 shows properties for a single Powerwall battery pack.

Table 3: Tesla Powerwall Specifications [13]

| Property   | Value                          |
|------------|--------------------------------|
| Price      | \$3000                         |
| Capacity   | 7 kWh                          |
| Power      | 2.0 kW continuous, 3.3 kW peak |
| Efficiency | 92%                            |
| Voltage    | 350 – 450 V                    |
| Current    | 5.8 A nominal, 8.6 A peak      |
| Weight     | 100 kg                         |
| Dimensions | 1300 mm x 860 mm x 180 mm      |

This analysis assumed that 7 kWh of energy can be cycled daily within the minimum and maximum state of charge limits, which are assumed to be 30% and 100% respectively. This implies a full capacity of 10 kWh which is assumed to cost \$3000, implying a price of \$300/kWh. We assume this cost includes installation and permitting, but additional analysis would be required to incorporate these costs at a specific site. \$160/kwh in 2018 assumed. This analysis assumed that the battery begins with 7 kWh of daily cycle life and is replaced once the maximum capacity has degraded to 70% of the original value. As detailed lifetime cycling information is not readily available, we assumed that the batteries can be fully cycled daily for five years beyond the stated 10-year warranty period before the battery capacity degrades to 70% of the original installed capacity, at which point the battery bank must be replaced. This implies about 365 cycles per year, for 15 years, or 5475 cycles.

## 2.2 Dispatch control strategies

### 2.2.1 Manual dispatch controller

The manual dispatch controller allows a user to choose how to charge and discharge the battery depending on the hour and month. This controller is described in detail in [8].

#### 2.2.1.1 Los Angeles

To account for the load profile seen in Figure 1, the manual controller was programmed with the schedule outlined in Table 1.

Table 1: LA Manual Dispatch Controller

| Month | Time                           | Strategy                                                                                       |
|-------|--------------------------------|------------------------------------------------------------------------------------------------|
| All   | 12 am – 6 am &<br>4 pm – 12 am | Charge from PV<br>Charge from Grid<br>Discharge up to 0.5% capacity each time step (5 minutes) |
| All   | 7am – 3 pm                     | Charge from PV<br>Charge From Grid                                                             |

#### 2.2.1.2 Knoxville

To account for the load profile seen in Figure 2, the manual controller was programmed with the schedule outlined in Table 2.

Table 2: Knoxville Manual Dispatch Controller

| Month | Time                            | Profile                                                                                        |
|-------|---------------------------------|------------------------------------------------------------------------------------------------|
| All   | 12 pm – 7 pm                    | Charge from PV<br>Charge from Grid<br>Discharge up to 0.5% capacity each time step (5 minutes) |
| All   | 12 am – 11 am &<br>8 pm – 12 am | Charge from PV<br>Charge From Grid                                                             |

# Largest grid batteries[\[Real case study\]](#)

| Name                                  | <a href="#">Commissioning date</a> | <a href="#">Energy (MWh)</a> | <a href="#">Power (MW)</a> | <a href="#">Duration (hours)</a> | Type           | Country | Refs                                                                                |
|---------------------------------------|------------------------------------|------------------------------|----------------------------|----------------------------------|----------------|---------|-------------------------------------------------------------------------------------|
| <a href="#">Buzen Substation</a>      | 3 March 2016                       | 300                          | 50                         | 6                                | Sodium-sulphur | Japan   | <a href="#">[35]</a> <a href="#">[36]</a> <a href="#">[37]</a>                      |
| <a href="#">Escondido Substation</a>  | 24 February 2017                   | 120                          | 30                         | 4                                | Lithium-ion    | USA     | <a href="#">[35]</a> <a href="#">[39]</a> <a href="#">[40]</a> <a href="#">[41]</a> |
| <a href="#">Pomona Substation</a>     | January 2017                       | 80                           | 20                         | 4                                | Lithium-ion    | USA     | <a href="#">[42]</a> <a href="#">[39]</a>                                           |
| <a href="#">Mira Loma Substation</a>  | 30 Jan. 2017                       | 80                           | 20                         | 4                                | Lithium-ion    | USA     | <a href="#">[43]</a> <a href="#">[44]</a> <a href="#">[45]</a>                      |
| <a href="#">Minamisōma Substation</a> | February 2016                      | 40                           | 40                         |                                  | Lithium-ion    | Japan   | <a href="#">[46]</a>                                                                |

# PART 2

## BATTERY Solutions & TECHNOLOGY

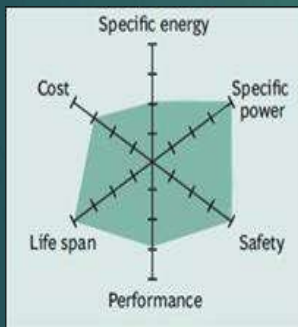


# Solutions Reliability

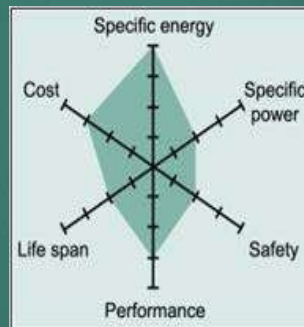
## Chemistry

only goes with LFP for safest operation and longest cycle-life

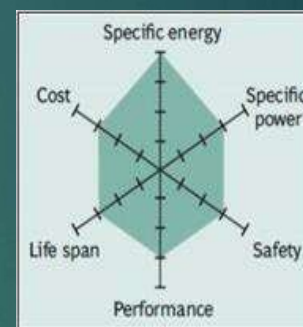
**LiFePO<sub>4</sub> (LFP)**



**LiCOO<sub>2</sub> (LCO)**



**NM  
C**



- Whilst Alpha's batteries are slightly larger per physical capacity versus other types of Li-Ion used in Electronics and EVs, they are easily banked in parallel close together because they don't suffer heat issues and thermal runaway. We have chosen LiFePO<sub>4</sub> for their superior life, safety and environmental performance.



# AlphaESS Solutions Reliability

Cell Type goes with Metal-Can cell for its longest Calendar Life

Small  
Cylindrical



3 years

Big Polymer  
Pouch



5 years

Plastic cell



7 years

Metal Can



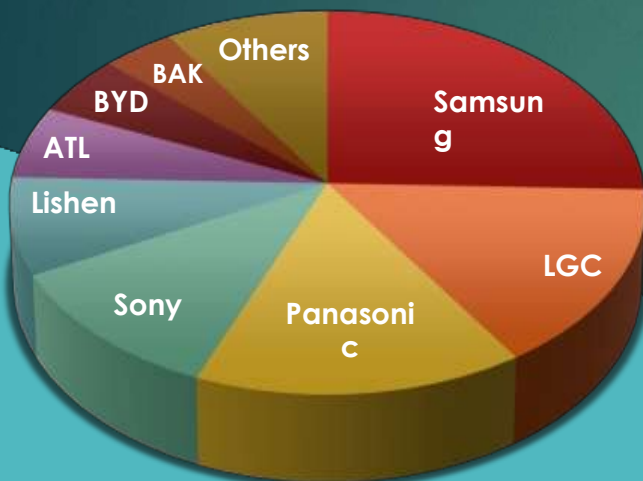
25 years

# Solutions Reliability



Millennium Electric T.O.U Ltd.  
www.millenniumsolar.com

## Premium Cells Supplier



never compromise  
on

LFP cell  
quality

| Chemistry         | LFP                   | LCO & NMC                |
|-------------------|-----------------------|--------------------------|
| Cell Type         | <b>SONY</b><br>       | <br><br><b>Panasonic</b> |
| Small Cylindrical |                       |                          |
| Big Polymer Pouch |                       |                          |
| Plastic Cells     |                       |                          |
| Metal CAN Cells   | <br><b>LISHEN</b><br> |                          |

- AlphaESS strategic partner - **LISHEN** - one of the world-top-5 LFP cell producers
- AlphaESS shareholder & partner - **EVE** - one of the tier-1 lithium battery producers in China

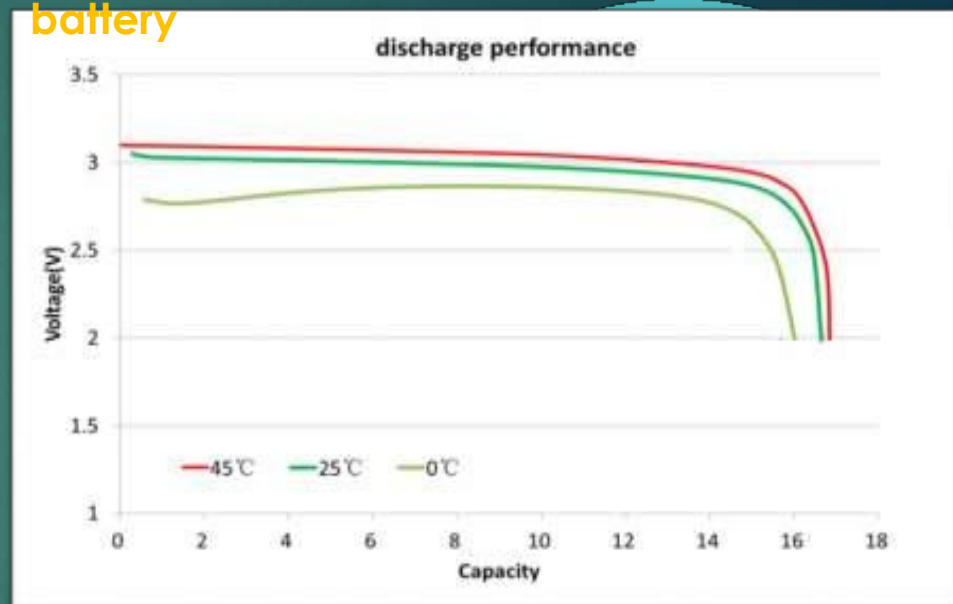
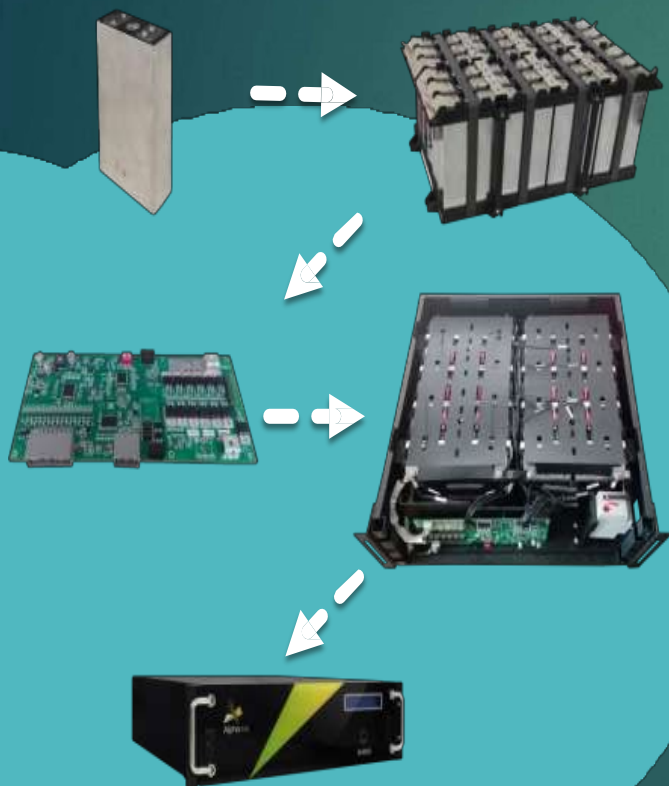
# Solutions Reliability



Millennium Electric T.O.U Ltd.  
www.millenniumsolar.com

BMS - EMS

BMS takes the best care of the battery



- Real-time volt. / temp./ current monitoring on cell
- level
- Multiple-level protections based on the data
- monitored Communication to EMS (Energy management System) Reliable battery cell balancing management
- Intelligent SOC% (State of Charge) algorithm

# PART 3 APPLICATION OF PV& LI\_ION BATTERY STORAGE



# Millennium Electric T.O.U. Ltd.

268 MW Commissioned



Commissioned 5 MW solar Projects, ITALY  
MIDUTZ YAKUM  
MSS revenues for FY 11 reach US \$13M

June 2011

Won Government tenders for 10,000 stand alone Solar farm in Mongolia and MSS in Malcia.  
revenues for FY 14 reach US\$30M

February 2012

Over 100 MW installations, balance sheet at US\$41M, 2014, won 7 MW Cyprus University rooftop

March 2014

Commissioned overall portfolio of 268 MW, & additional 250 MW orders in hand, 30 Clients, O&M revenue of major EPC and upcoming IPP player

September 2015

Cyprus University park  
Awarded the first 12 MW as an IPP

June 2015

First entry in Phillippines won 272 kw on Casino and 3 MW rooftop in Romania

2013

CORPORATE SPECIAL PATENTS  
RUNNING 11 R&D EU PROJECTS  
PVT MULTI SOLAR SYSTEM  
MULTI SOLAR CO-GENERATION  
MULTI SOLAR DESALINATION  
MULTI SOLAR AIR CONDITIONING  
MULTI SOLAR H<sub>2</sub> PRODUCTION  
MULTI SOLAR WINDOW/WALL

2002 - 2009

13 MW projects commissioned, ITALY and MSS at Margon Michael  
revenues for FY 10 reach \$30M

JULY 2010

Millennium by back out of NASDAQ

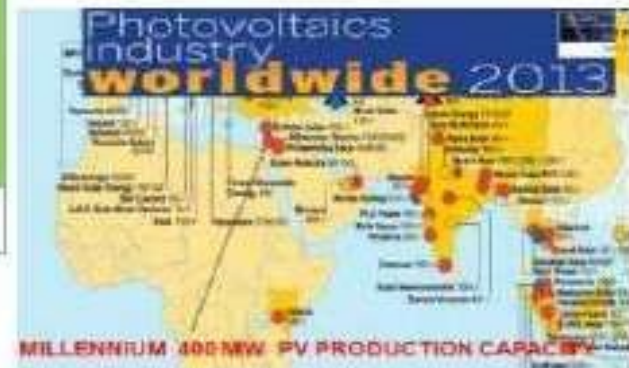
March 2007

USA NASDAQ

2003-2007

SPAIN 12 MW commissioned and another 21MW KOREA

2008 - 2009



Millennium Electric T.O.U Ltd.  
www.millenniumsolar.com





# Millennium Projects World wide

## 268 Megawatt Projects (completed )

Millennium Electric TOU Ltd

Global Partners and Installations



# Millennium Battery Storage Solutions

## 56 Megawatt Energy Storage Project









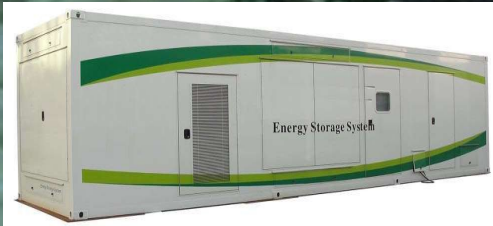
# BESS REPLACE --- PUMPED ELECTRICITY

017

Electricity and Energy Storage - World Nuclear Association

**\$200-300 / KWH FOR 20 YEARS**  
**MODULAR 3 MONTH INSTALATION**  
**NO O&M NO LIMIT SIZE**

**\$-2000 KWH 10 YEARS**  
**15% O&M ,INSTALATION TIME**  
**5 YEARS MINIMUM LIMIT SIZE LOCATION**



*This schematic of the Gordon Butte project is typical of pumped storage (Gordon Butte)*

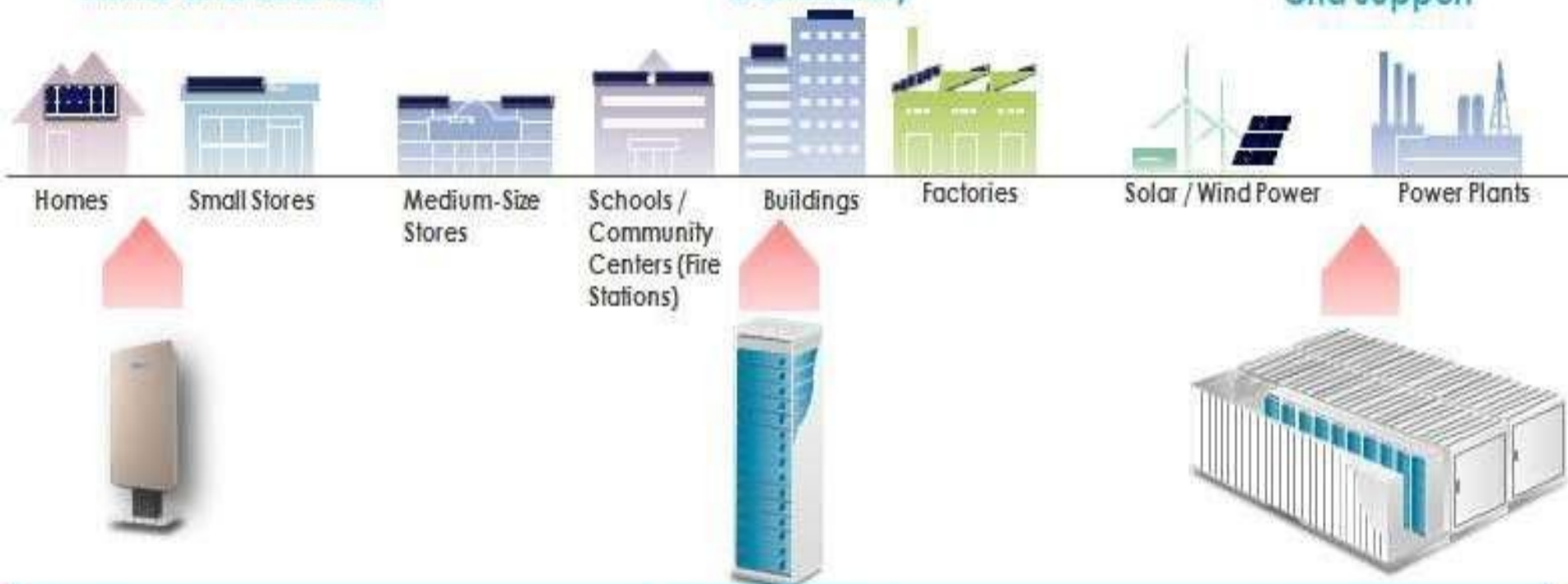
# Millennium Battery Storage Solution

Comprised of storage batteries and control units to manage charging and discharging, Millennium Energy Storage Solution is suitable for various applications (e.g. Residential Energy Storage, Community Energy Storage, Utility scale ancillary services, etc.). Through the unique control method and know-how of managing energy storage, the system can control systems with over 1,000 storage batteries as part of a 2-MWh or greater system

## Home and Business

## Community

## Grid Support



4KWh~15Kwh

30 KWh~500KWh

>500KWh~ 2MWh



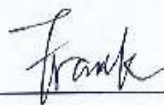


## Authorized Distributor Certificate

Trina Energy Storage Solutions (Jiangsu) Co., Ltd develops, manufactures and delivers the world's most reliable and cost-effective energy storage solutions. We Trina Energy Storage Solutions (Jiangsu) Co., Ltd hereby confirms that the

### **Amitec Information Industry Security special service Ltd.**

Located at 179 Namir Ave., PO Box 48466, Tel Aviv North Industrial Zone 61481001, Israel, is authorized to distribute our products in Israel Africa. It is valid for one year from 04/28/2017 to 04/27/2018.



Frank Qi, General Manager



ALPHA ESS CO., LTD.

## Authorized Certificate

This certifies that

**Millennium Electric T.O.U. Ltd**

is an partner of AlphaESS.

It is authorized to promote, sell and install AlphaESS  
products in Israel from  
April 2017 to April 2018.



# MILLENNIUM TIME OF USE (T.O.U) SYSTEM

## Product Brief

### TIME OF USE APPLICATIONS

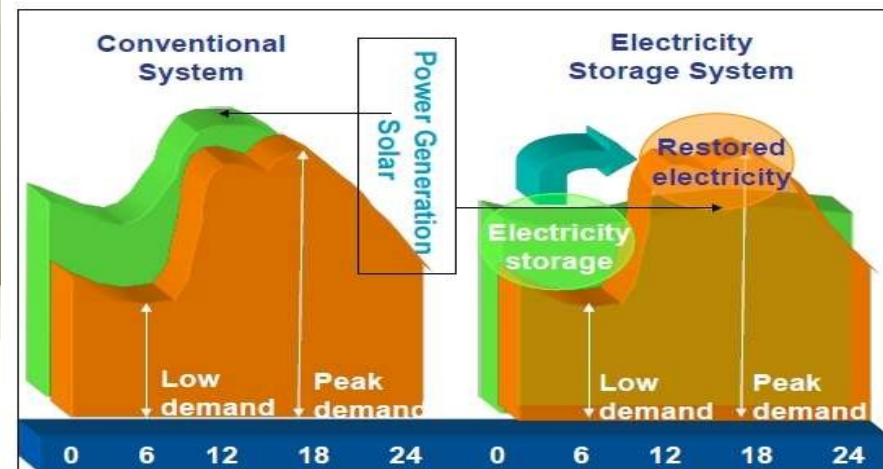


As air-conditioners hummed this summer, and experts issued dire warnings about electricity running short, a growing number of utilities varied the price of power based on supply and demand to make sure there is enough to go around.

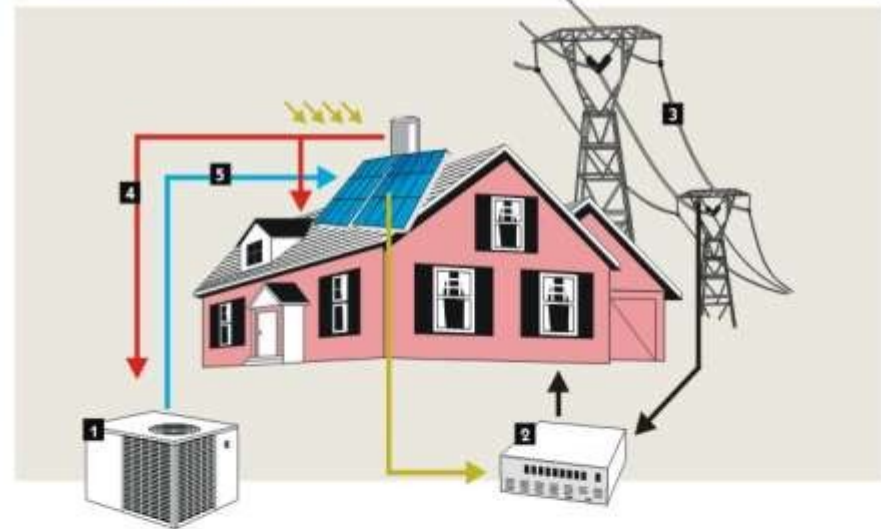
Many utility companies around the world offer variable prices for electric consumption at Peak and Off Peak hours. Imagine if you could store the electricity during the off peak hours and then use the same electricity at peak hours instead of paying the utility for the more expensive rate. The Time Of Use (TOU) System does just that!



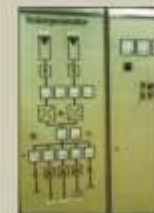
The world's largest battery energy storage system.



### T.O.U. Diagram



1. Air Conditioning
2. Electricity Storage
3. Energy Power
4. Hot Water



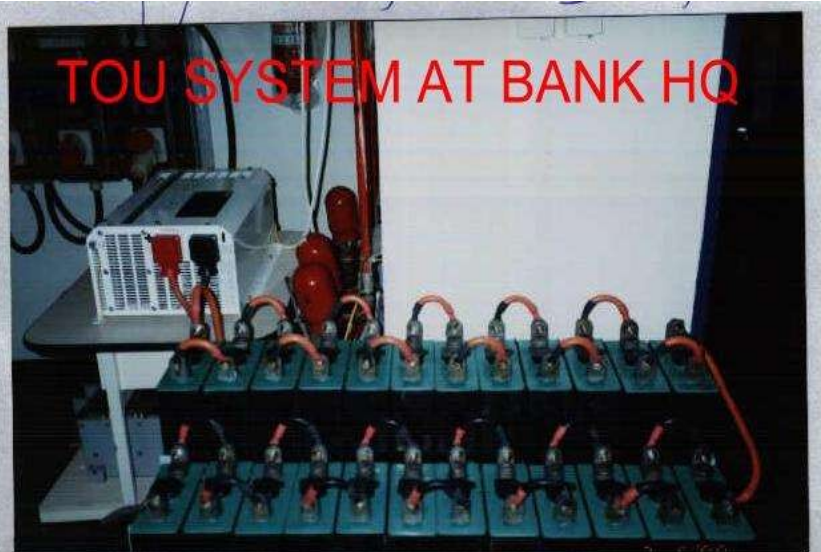
Solar Generator Control



The battery energy storage



# THE T.O.U SYSTEM IN USE BANK DISCOUNT 2000

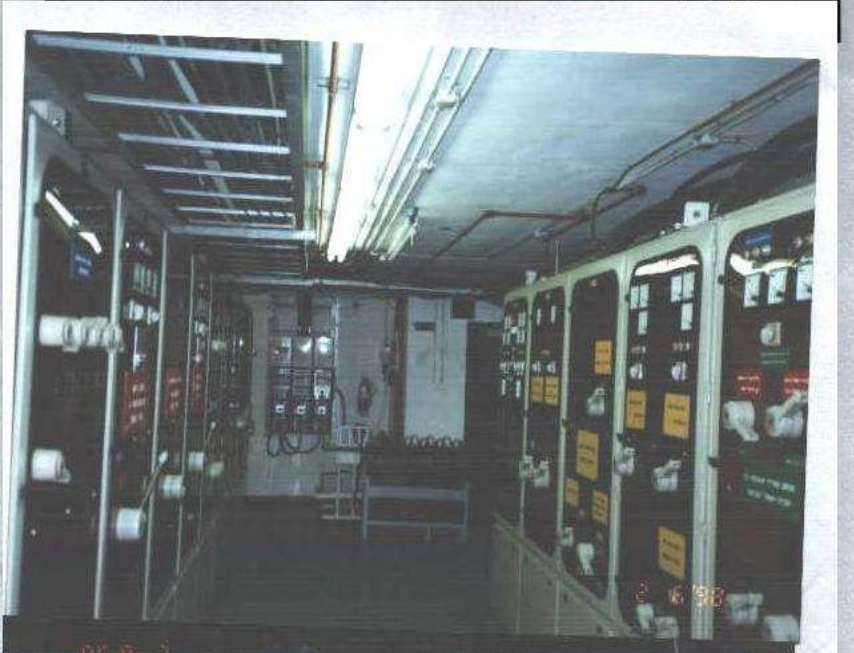


The Rational for this T.O.U. technology is differential in prices for peak and off peak electricity demand.

The device buy off- peak electricity at law price –2 cents per kwh and use it at on-peak and on demand high cost electricity11- 18 cents per kwh and up.

The device can sell electricity back .

In the picture a tou system working in bank discount



# בנק דיסקונט לישראל

אגף נכסים ובניין  
מחלקת בניין ותקשורת  
רח' הרצל 160 ת"א, 68101 טל': 03-5153122 פקס': 03-6814444

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עמי אלעזרי  
מנכ"ל

מילניום אלקטריק בע"מ  
הסדנה 7 איזור התעשייה רעננה  
ת.ד. 16007  
תל אביב מיקוד 61160  
טלפון: 09-7442369 פקס: 09-7407511

הנדון: הפעלת מתקן הסטת עומס (חסכון) בעלות חשמל.

א.ב.

הרינו מאשרים בזאת כי החל מתאריך מרץ 1999 ועד ספטמבר 2000 הופעל  
אצלנו בהצלחה מלאה מתקן חסכון בחשמל מתוצרת חברתכם, שהותקן בבנין  
ההנהלה של בנק דיסקונט ברחוב הרצל מס 160 יפו תל אביב.

המתקן הורכב בחדר החשמל בקומת המרתף של הבנק והופעל בו לנסיון 40 מנורות של 80 ואט כל אחת בהספק  
כולל של 3.5 קילוואט.

המתקן כולל ממיר מטען ( אינורטר צארגר) של 5 קילוואט, מיקרו פרוססור לבקרה ושליטה על שעות הטעינה  
הפריקה וכמות החשמל הנאגר ומסופק.  
המתקן תוכנן כך שכל לילה בין השעות 2400 ל 0800 בעת שהחשמל זול הוא טען את מערך האגירה ולאחר מכן  
בשעות השיא של מחיר החשמל נפרק מערך האגירה לצורך תאורה באיזור מרתף החניה בשעות היום.

כאמור המתקן עבד אצלנו במשך 18 חודש ללא תקלה ובהתאם לתכנית היצרן והביא לחסכון בעלות החשמל  
בפועל.

גברת

רפי לוי

מנהל מחלקת בניין ותקשורת



| פירעט    | פיק          | פירעט       |
|----------|--------------|-------------|
| עמ אלל"מ | מ            | גוא 'עמ אלל |
| הובג חתמ | ילי הובג חתמ |             |
| 115.59   | 107.04       |             |
| 68.01    | 45.17        |             |
| 43.44    | 29.98        |             |

| פירעט    | פירוח        | פירעט       |
|----------|--------------|-------------|
| עמ "מ    | מ            | -רבכ'עמ אלל |
| אלל הובג | צד הובג חתמ' |             |
| 92.29    | 92.85        |             |
| 55.60    | 54.90        |             |
| 35.6     | 32.71        |             |

| פירעט    | פירעט         | פירעט |
|----------|---------------|-------|
| עמ אלל"מ | מ             | פירעט |
| הובג חתמ | טפס הובג חתמ' | פירעט |
| 57.08    | 45.03         | פירעט |
| 49.06    | 36.26         | פירעט |
| 31.98    | 28.88         | פירעט |

|     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| א-ה | א-ה | א-ה | א-ה | א-ה | א-ה | א-ה | א-ה | א-ה |
| 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   |
| 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   |
| 4   | 4   | 4   | 4   | 4   | 4   | 4   | 4   | 4   |
| 5   | 5   | 5   | 5   | 5   | 5   | 5   | 5   | 5   |
| 6   | 6   | 6   | 6   | 6   | 6   | 6   | 6   | 6   |
| 7   | 7   | 7   | 7   | 7   | 7   | 7   | 7   | 7   |
| 8   | 8   | 8   | 8   | 8   | 8   | 8   | 8   | 8   |
| 9   | 9   | 9   | 9   | 9   | 9   | 9   | 9   | 9   |
| 10  | 10  | 10  | 10  | 10  | 10  | 10  | 10  | 10  |
| 11  | 11  | 11  | 11  | 11  | 11  | 11  | 11  | 11  |
| 12  | 12  | 12  | 12  | 12  | 12  | 12  | 12  | 12  |
| 13  | 13  | 13  | 13  | 13  | 13  | 13  | 13  | 13  |
| 14  | 14  | 14  | 14  | 14  | 14  | 14  | 14  | 14  |
| 15  | 15  | 15  | 15  | 15  | 15  | 15  | 15  | 15  |
| 16  | 16  | 16  | 16  | 16  | 16  | 16  | 16  | 16  |
| 17  | 17  | 17  | 17  | 17  | 17  | 17  | 17  | 17  |
| 18  | 18  | 18  | 18  | 18  | 18  | 18  | 18  | 18  |
| 19  | 19  | 19  | 19  | 19  | 19  | 19  | 19  | 19  |
| 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  |
| 21  | 21  | 21  | 21  | 21  | 21  | 21  | 21  | 21  |
| 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  |
| 23  | 23  | 23  | 23  | 23  | 23  | 23  | 23  | 23  |
| 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  |

|          |                          |          |               |          |          |           |    |               |
|----------|--------------------------|----------|---------------|----------|----------|-----------|----|---------------|
| 49       | 33                       | 130      | 13            | 13       | 64       | 9         | 9  | 44            |
| 14       | 2                        | 6        | 7             | 7        | 7        | 7         | 7  | 7             |
| 4        | 14                       | 2        | 2             | 4        | 2        | 24        | 24 | 10            |
| 20       | 10                       | 8        | 20            | 20       | 16       | 24        | 24 | 24            |
| 24       | 24                       | 24       | 24            | 24       | 24       | 24        | 24 | 24            |
| 0        | 0                        | 1820     | 26            | 0        | 384      | 0         | 0  | 308           |
| 16,710 ₪ | 11,254 ₪                 | 55,056 ₪ | 11,352 ₪      | 6,712 ₪  | 55,888 ₪ | 44,295 ₪  | 44 | הס"פירוחמ ינש |
| 212      | הס"רבעמ תונוע מירוחממ כ: | 154      | הס"פירוחמ ינש | 33,045 ₪ | 19,689 ₪ | 12,406 ₪  | 44 | הס"פירוחמ ינש |
| 13,309 ₪ | 8,963 ₪                  | 35,310 ₪ | 3,999 ₪       | 3,999 ₪  | 19,689 ₪ | 31,889 ₪  | 44 | הס"פירוחמ ינש |
| 3,401 ₪  | 2,290 ₪                  | 19,746 ₪ | 7,353 ₪       | 2,713 ₪  | 36,199 ₪ | 117,365 ₪ | 44 | הס"פירוחמ ינש |
| 25,437 ₪ | הס"רבעמ תונוע כ:         | 59,622 ₪ | הס"פירוחמ ינש | 13,357 ₪ | 31,889 ₪ | 116,948 ₪ | 44 | הס"פירוחמ ינש |

| רבעמ תונוע רוחה | פירוחמ רוחה | פירוחמ רוחה | הס"כ    |
|-----------------|-------------|-------------|---------|
| הגספ            | הגספ        | הגספ        | הגספ    |
| 27%             | 37%         | 17%         | 81%     |
| עבג             | עבג         | עבג         | עבג     |
| 14%             | 5%          | 19%         | 19%     |
| הס"כ:הס         | הס"כ:הס     | הס"כ:הס     | הס"כ:הס |
| 27%             | 51%         | 22%         | 100%    |

|            |
|------------|
| וקתמ תולוע |
| 1000KWH    |
| 150,000 \$ |
| 552,000 ₪  |

|            |
|------------|
| פירעט רוחה |
| 4.72       |

|      |
|------|
| הגספ |
| עבג  |
| לפש  |

|               |
|---------------|
| רבעמ לדוג KWH |
| 1000          |

|              |
|--------------|
| הניעט תוליצנ |
| 99%          |

|              |
|--------------|
| הקירפ תוליצנ |
| 99%          |

|              |
|--------------|
| פירבצמ לוצינ |
| 95%          |

|                |
|----------------|
| פירשדוחב פירמי |
| 364            |
| הגספ           |
| עבג            |
| לפש            |

|                |
|----------------|
| הנשב הגספ תועש |
| 2538           |
| למשח תריכמ     |
| ררע            |
| 234,314 ₪      |

|                    |
|--------------------|
| פירבצמ תניעט תולוע |
| 117,365 ₪          |

|           |
|-----------|
| יקנ חוור  |
| 116,948 ₪ |

|          |
|----------|
| רלוד רעש |
| 3.68     |

**1 MEGA BATTERY BANK FOR FACTORY PV SOLAR SYSTEM BATIPALYA ITALY 1998**





**24 BATTERIES OF 48KWH 1 MGH EACH SUPPORT NIGHT SHIFT LIGHT FOR THE FACTORY**



# Millennium Battery Storage Solutions

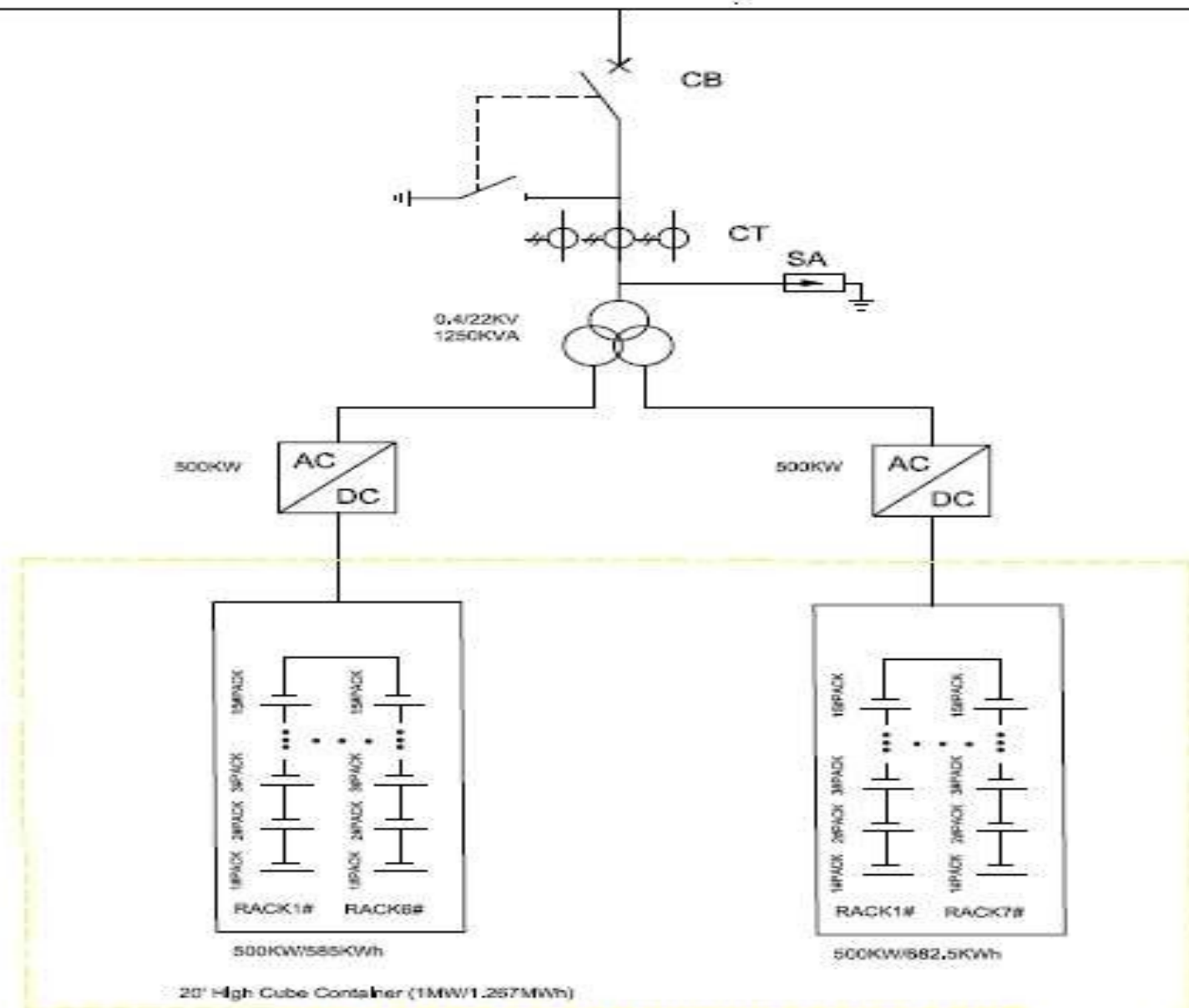
## 56 Megawatt Energy Storage Project





# 1 MWH SCHEMATIC 1 CONTAINER

22KV Busbar





## Millennium 1MWh Level Energy Storage System



## 1 Scope of Specification

The scope of specification is limited to Energy Storage System-1MWh designed and produced by Millenniu Energy Storage Solution CO., LTD, with cell supplied from Tianjin Lishen Battery Joint-stock CO., LTD.

## 2 Standards and Specifications

ISO2875: 2000, Packaging-Complete, filled transport packages and unit loads-Water spray test, IEC 60255-21-2: 1988 Shock and bump tests on measuring relays and protection equipment

ISO 780: 1997 Packaging - Pictorial marking for handling of goods

IEC 60068-2-1: 2007 Environmental testing - Part 2: Test methods - Tests A:  
Cold

IEC 60068-2-2: 2007 Environmental testing - Part 2: Test methods - Tests B: Dry  
heat

IEC 60068-2-78: 2001 Environmental testing for electric and electronic products  
- Part 2: Testing method test Cab: Damp heat, Steady state

IEC 60068-2-32: 1990 Environmental testing for electric and electronic products  
- Part 2: Test methods - Test Ed: Free fall

IEC 60068-2-6: 1995 Environmental testing for electric and electronic products - Part 2: Tests methods - Test Fc: Vibration (sinusoidal)

IEC 60947-1: 2001 Low-voltage switchgear and control gear—Part 1: General  
rules

GB/T 15945-2008 Power quality - Frequency deviation for power system GB/T 12325-2008 Power quality - Deviation of supply voltage

GB/T 15543-2008 Power quality - Three-phase voltage unbalance IEC 61000-3-7 Power quality - Voltage fluctuation and flicker

GB/T 14549-1993 Quality of electric energy supply - Harmonics in public supply network

IEC 62053-22: 2003 Electricity metering equipment (a.c.) - Particular requirements - Part 22: Static meters for active energy (classes 0, 2 S and 0, 5 S)

IEC 1038: 1990 Multifunction electricity metering equipment

IEC 1107 Multi-function watt-hour meter communication protocol

IEC 62493: 2009 Assessment of lighting equipment related to human exposure to electromagnetic fields



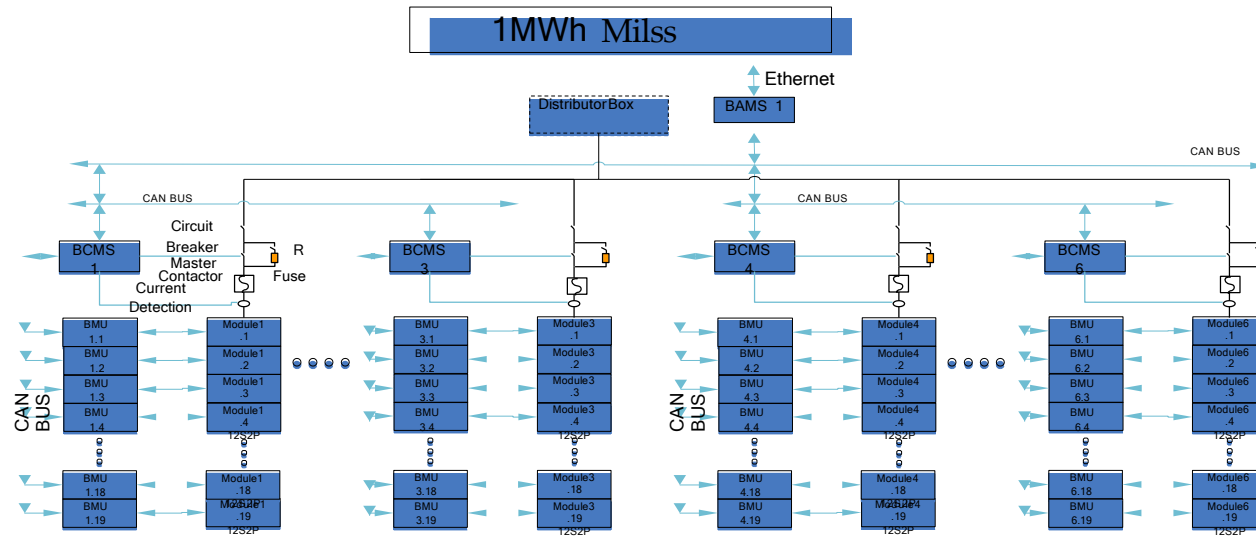


Figure1 System Grouping

## 4.2 System Configuration

Table2 System Configuration

| No. | Item                | Specifications | unit | No. | Remarks                                                |
|-----|---------------------|----------------|------|-----|--------------------------------------------------------|
| 1   | Battery System      | 1MWh           | Set  | 1   | Including batteries、battery modules                    |
| 2   | BMS                 | 1MWh           | Set  | 1   | Including a complete set of BMS and wire harness       |
| 3   | HVC                 |                | Set  | 6   | Including high voltage control box and some devices    |
| 4   | High Voltage Device |                | Set  | 1   | Including high voltage device cabinet and some devices |

#### 4.4.2 Size and Appearance of Module

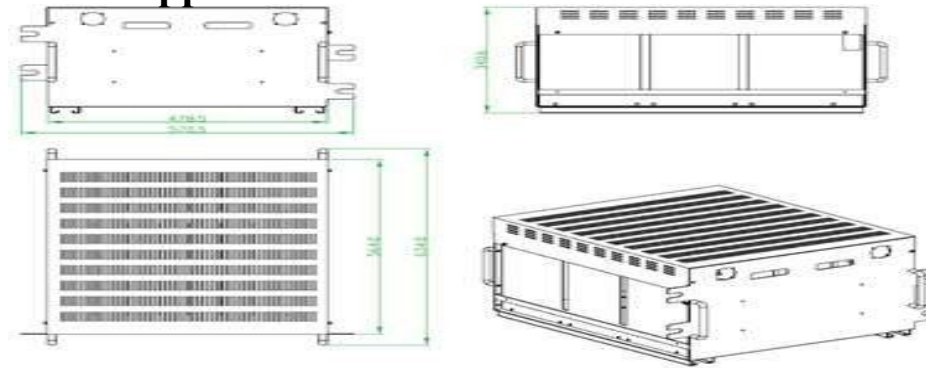


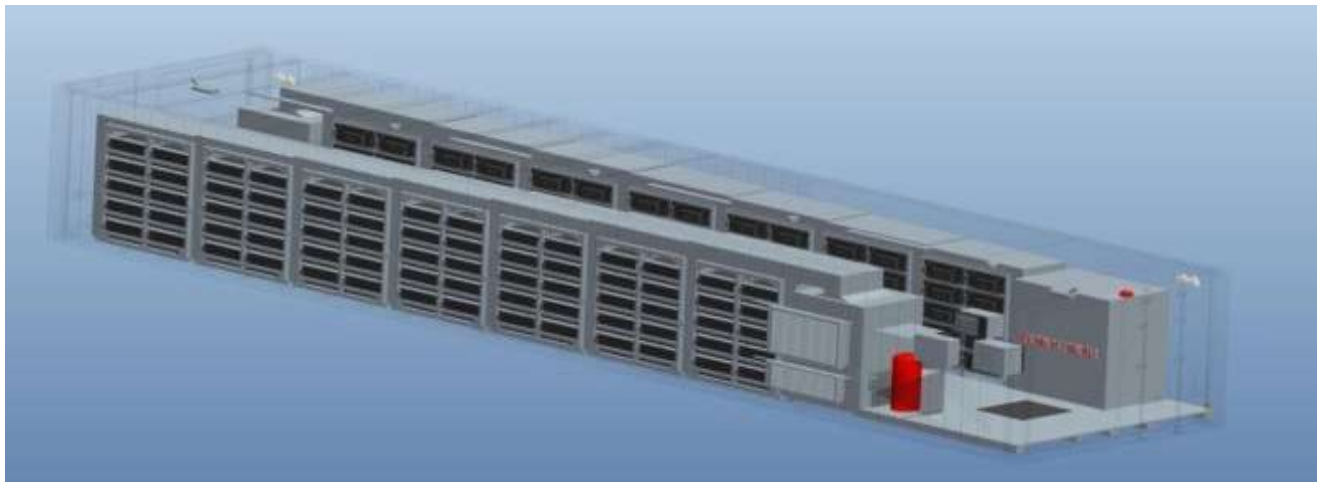
Figure3 Size and Appearance of Module

#### 4.4.3 Container



Energy

Smarten Your





Millennium 1 megawatt PVT green  
house BATTERY  
ITALY 2010





Millennium 1megawatt PVT green house  
BAT done ITALY  
2011



# China Shandong MSS PVT Green house



Millenniu Green House in China 2014 -2016  
m  
(Shandong)



Advantage: Application hot water entering the plants roots improve furits and cool the panels  
Patent: combining the Millenniu PVT MSS and Green House agriculture  
patented

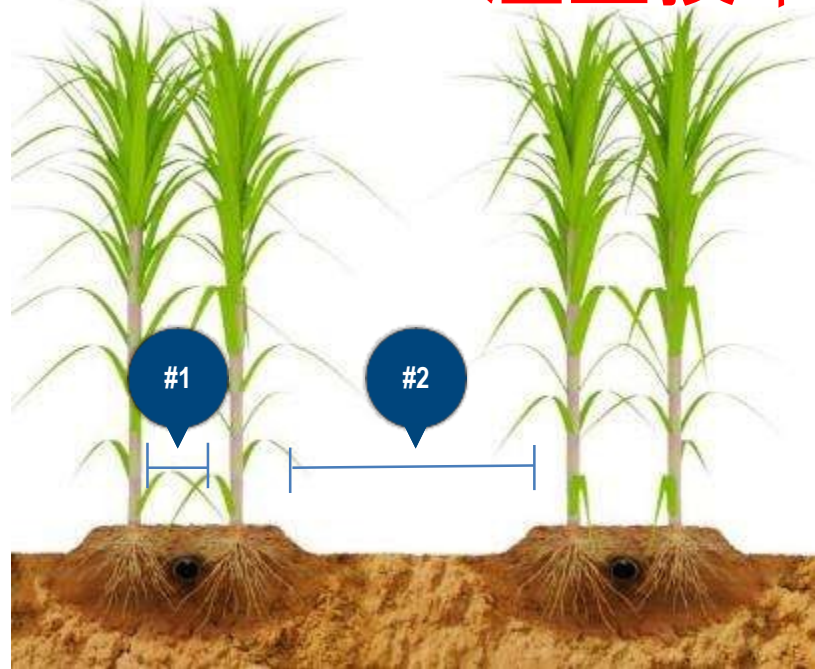




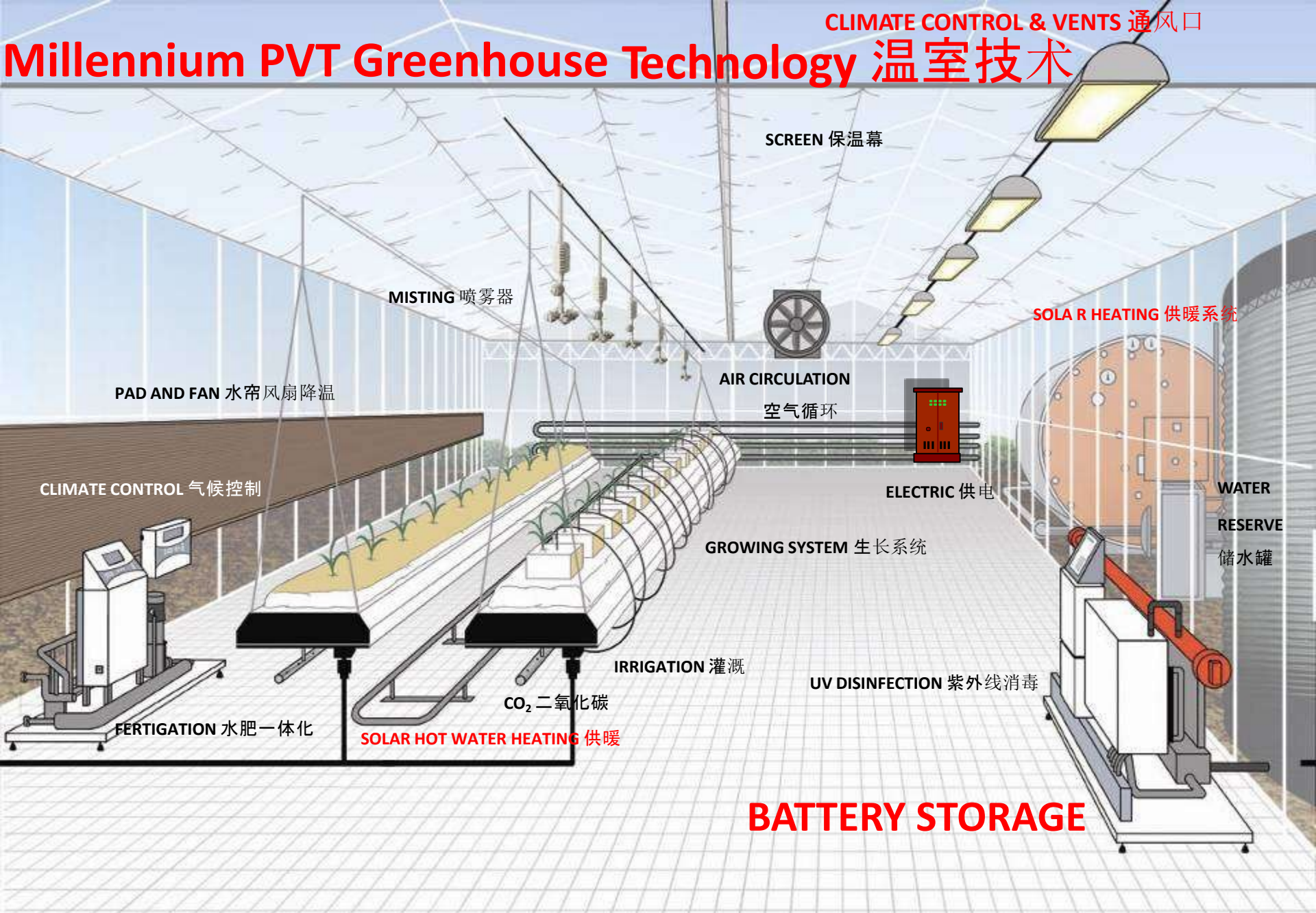
# Conventional Single-Row Planting 传统的单排种植

## PVT Greenhouse Technology & BATTERY 温室技术

- ▶ Emitter spacing 滴头间距:  
0.4m-0.6m
  - ▶ Emitter discharge 滴头流量:  
0.6-1.3 l/hr
  - ▶ Optimal stalk  
population 最优株数:  
130,000 plants/ha
1. Distance between  
adjacent rows 相邻近行距:  
0.4m-0.6m
  2. Distance between  
far rows 相邻远行距:  
1.4m-1.9m



Plant Roots SOLAR HOT WATER HEATING 供暖



CLIMATE CONTROL & VENTS 通风口

# Millennium PVT Greenhouse Technology 温室技术

SCREEN 保温幕

MISTING 喷雾器

PAD AND FAN 水帘风扇降温

CLIMATE CONTROL 气候控制

AIR CIRCULATION  
空气循环

SOLAR HEATING 供暖系统

ELECTRIC 供电

WATER  
RESERVE  
储水罐

GROWING SYSTEM 生长系统

IRRIGATION 灌溉

UV DISINFECTION 紫外线消毒

CO<sub>2</sub> 二氧化碳

SOLAR HOT WATER HEATING 供暖

FERTIGATION 水肥一体化

BATTERY STORAGE

Plant Roots SOLAR HOT WATER HEATING 供暖

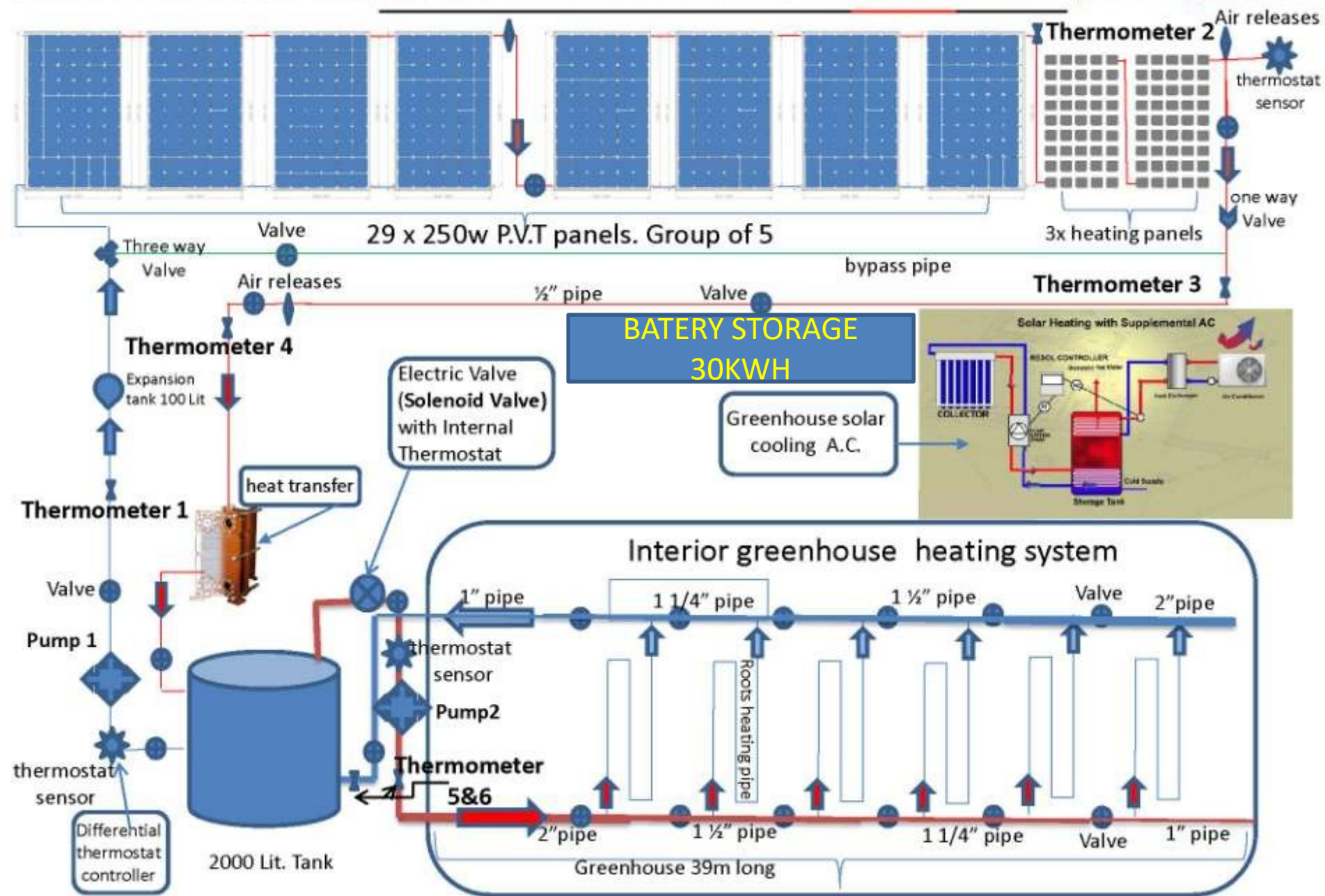


**PVT SOLAR GREENHOUSE WITH BATTERY IN  
ISRAEL DESERT KTURA CENTER 2018**



# PVT Solar Collectors

CHINA GREEN HOUSE Integrated solar MILLENNIUM EAC EnviroDome **cooling/heating** system





# HOT WATER TANK FOR MSS GREEN HOUSE CHINA





CONTROLLING THE GREEN HOUSE AIR CONDITIONING CHINA



## 2. 以色列艾森贝克农业设备（北京）有限公司介绍

艾森贝克农业设备（北京）有限公司（以下简称艾森贝克农业）是1992年进入中国的第一家以色列农业公司，注册资金241.67万美元。公司提供从项目前期农业策划、项目设计、设施建造、集成，到项目的后期农艺支持及运营管理等一条龙服务，是农业科技的整体解决方案的提供商。

艾森贝克与以色列PVT技术专利方共同研发的光伏农业一体化温室已经获得实用新型专利和发明二项专利，通过PVT技术在提供传统光伏板的发电效率的同时，为温室提供热能供温室进行加温，在山东滨州的EnviroDome光伏农业一体化试验温室中成功种植热带水果火龙果。



# THE GOVERNOR VIST THE MIL-ISENBERG CHINA MSS PVT GREEN HOUSE







# Millennium Present first Solar Green house



millennium

|             |                                                                                           |
|-------------|-------------------------------------------------------------------------------------------|
| 15:00-15:30 | 演讲嘉宾: Eisenberg Agri (Beijing) Company Limited<br>Patrick Hastings<br>演讲题目: 以色列农业科技整体解决方案 |
| 15:30-16:00 | 演讲嘉宾: Noberfun (China) Chemical Ltd., Co.<br>演讲题目: 水肥一体化与水溶性肥料                            |
| 16:00-16:30 | 演讲嘉宾: Hazera Quality Seeds 果振军<br>演讲题目: 海泽拉优质育种技术与种子品质保障                                  |
| 16:30-17:00 | 演讲嘉宾: Millennium Electric Jack Ramon<br>演讲题目: PVT 热电联产技术                                  |
| 17:00-17:30 | 演讲嘉宾: 瑞沃丽斯灌溉技术有限公司 张政委<br>演讲题目: 以色列灌溉技术在中国应用的成功经验                                         |
| 17:30-17:50 | 以色列专家与中国企业交流互动                                                                            |
| 17:50-18:00 | 光伏农业项目对接互动                                                                                |

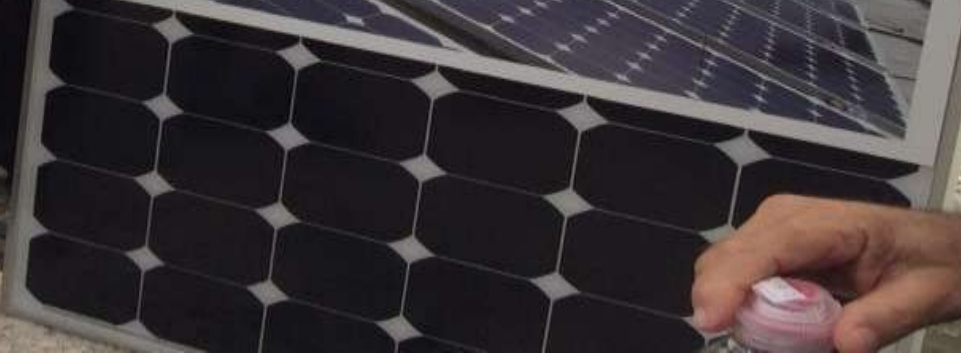


# TIBET 80 GREEN HOUSE PROJECT



**Millennium Electric T.O.U Ltd.**  
www.millenniumsolar.com

Millennium-Electric is a manufacturer and world leader in PV/PVT technologies with an experience of 20 years. The company installed \$26MW worldwide and has a manufacture capacity of 800MW. Millennium developed unique PV technologies with a competitive advantage: the PV-Thermal collector which enables up to 30% more electrical production than usual PV and thermal energy production; the M53 Co-Generation and panels with 19% efficiency.



# TIBET 80 GREEN HOUSE PROJECT





# TIBET 80 PVT GREEN HOUSE PROJECT WITH 30KWH BATTERY STORAGE EACH

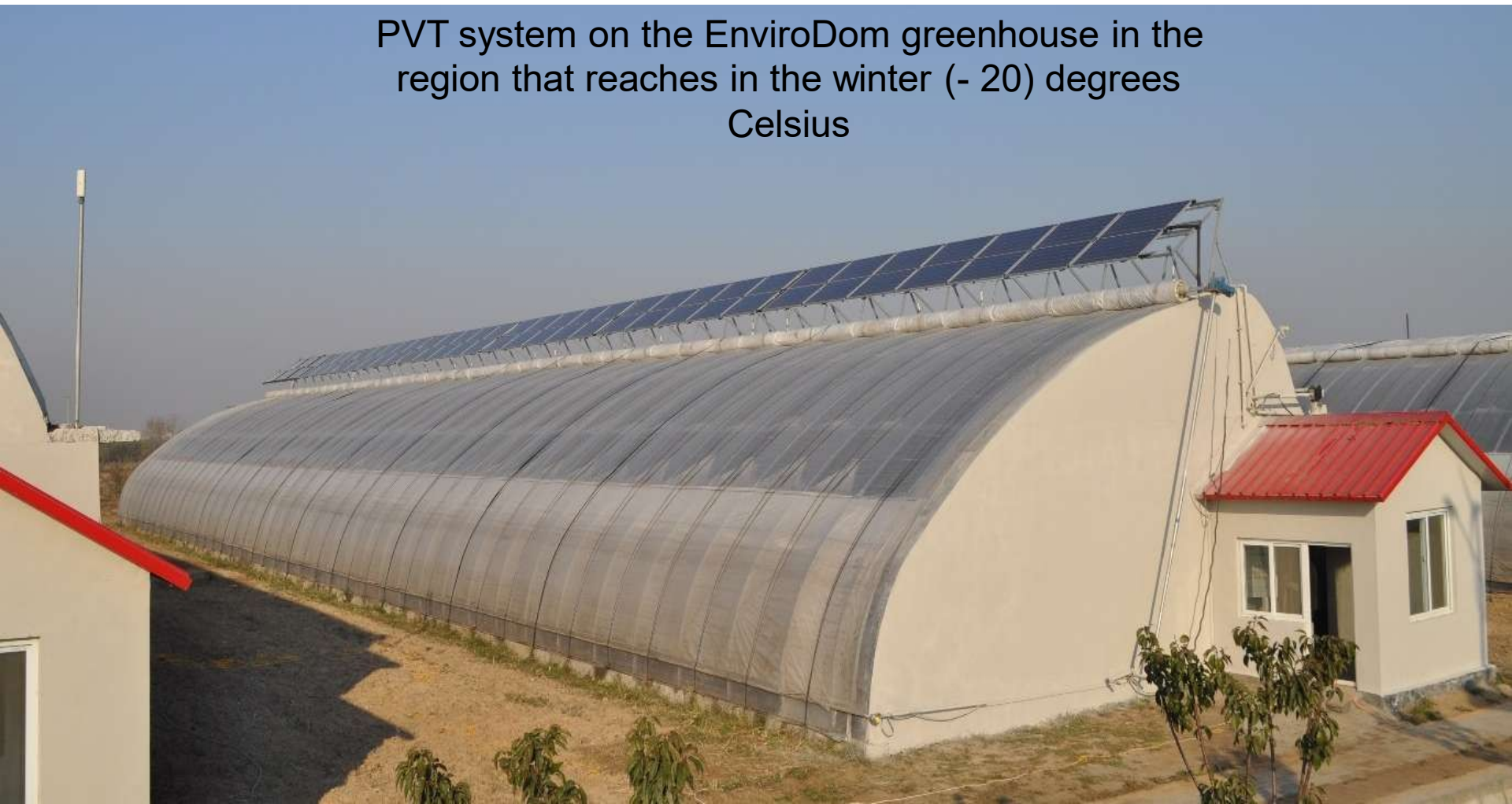




# MILLENNIUM PVT Solar Collectors

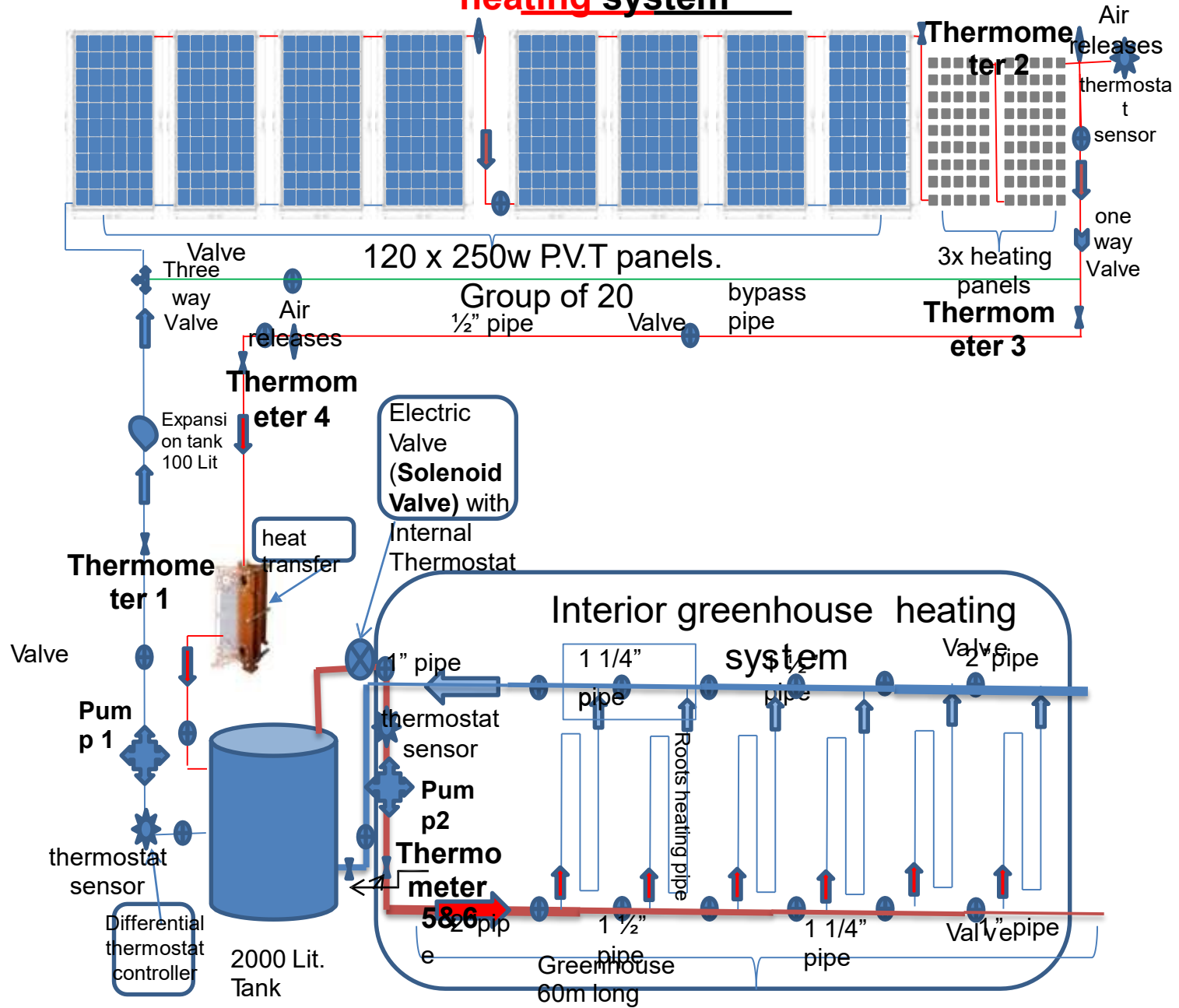
## Integrated solar EnviroDome heating system

PVT system on the EnviroDom greenhouse in the region that reaches in the winter (- 20) degrees Celsius



# PVT Integrated solar EnviroDome

## heating system



Patent registration in IL  
USA China



(19) State Intellectual Property Office of the P.R.C

## (12) Patent Application for Utility Model



(09)PVT COLLECTOR PATENT US 60/907007

(08)IL 205146 PCT 000368 GRANTED MAY 2017

(10) Authorization Issue No.: CN 204612201 U

(45) Authorization Issue Date: September 2, 2015

(09)PVT COLLECTOR PATENT US 60/907007

(08)IL 205146 PCT 000368 GRANTED MAY 2017

**INVENTOR Ami Elazari**

(21) Application No.: 201520054973.3

(22) Application Date: January 27, 2015

(73) Patentee: Han Xiaohua

Address: Room 501, Door 6, Floor 2, Building A-1, Jiajia Garden, Fengtai District, Beijing 100079

Patentees: Avi Hapaert; Jacob Hanau-Ramon; Lu Yalong

(72) Inventors: Han Xiaohua; Avi Hapert; Jacob Hanau-Ramon; Lu Yalong

(51) Int. Cl.

F24J 2/40 (2006.01)

F24D 19/10 (2006.01)

(ESM) Same invention has applied for patent for invention the same day.





# Shigatse Tibet - Sino-Israeli Agro-Solar Argo-tech and Profit Model Demonstration Park

The project utilized the 80 EnviroDome Energy Saving greenhouse system to produce fruit and vegetables and 2.8 Mw electrical power on the plateau in this landmark project.



The business model enables a particularly attractive ROI. In the winter seasons farmers do not grow due to cold weather. The PVT system enables the heating of the greenhouse and the roots of the crops, enabling winter growth. The electricity produced by the system is sold to the grid.

**A two-channel business model, agriculture and electricity**



# GAHANA BATTERY STORAGE WITH PV





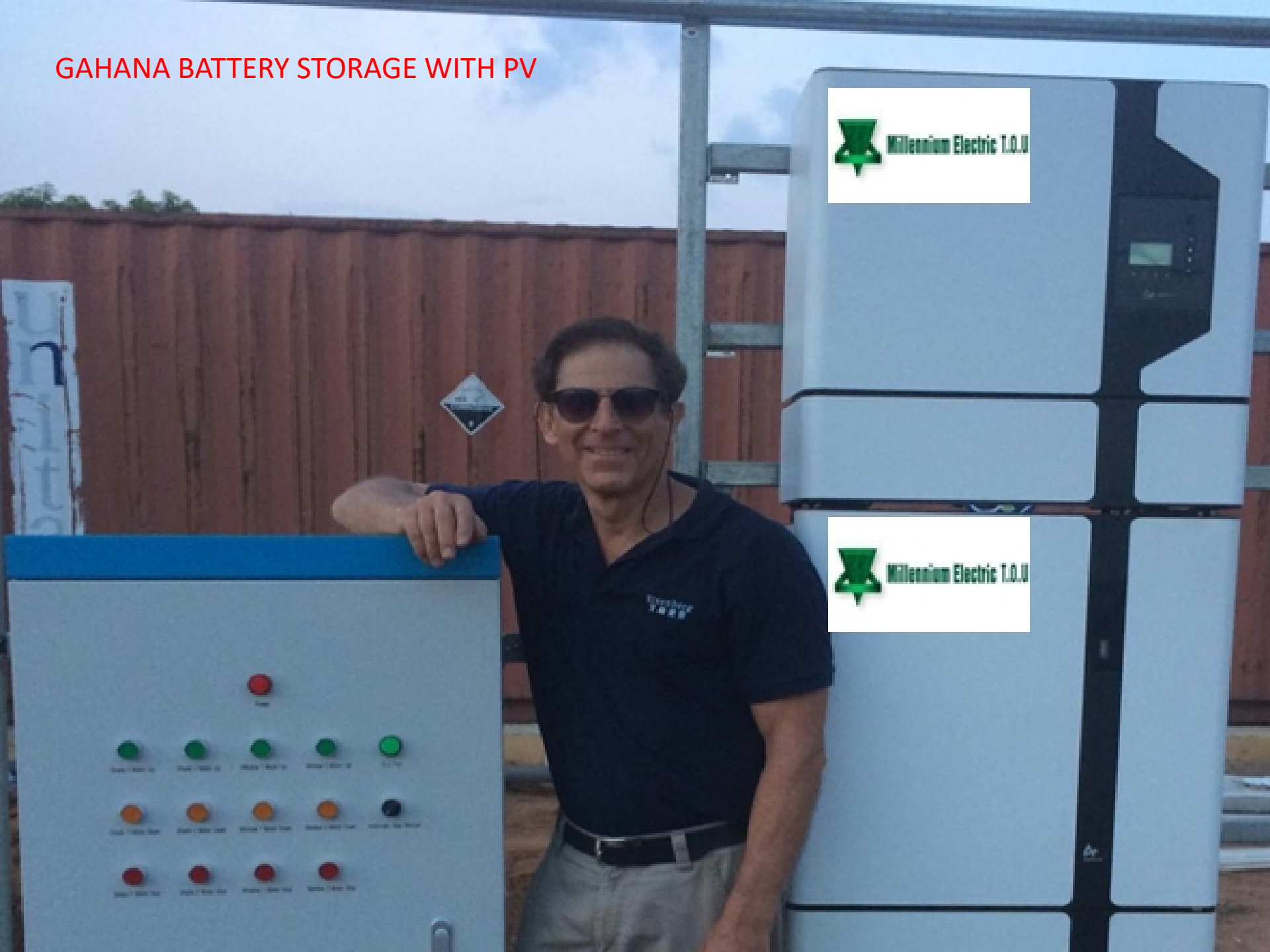






Millennium Electric T.O.U

## GAHANA BATTERY STORAGE WITH PV





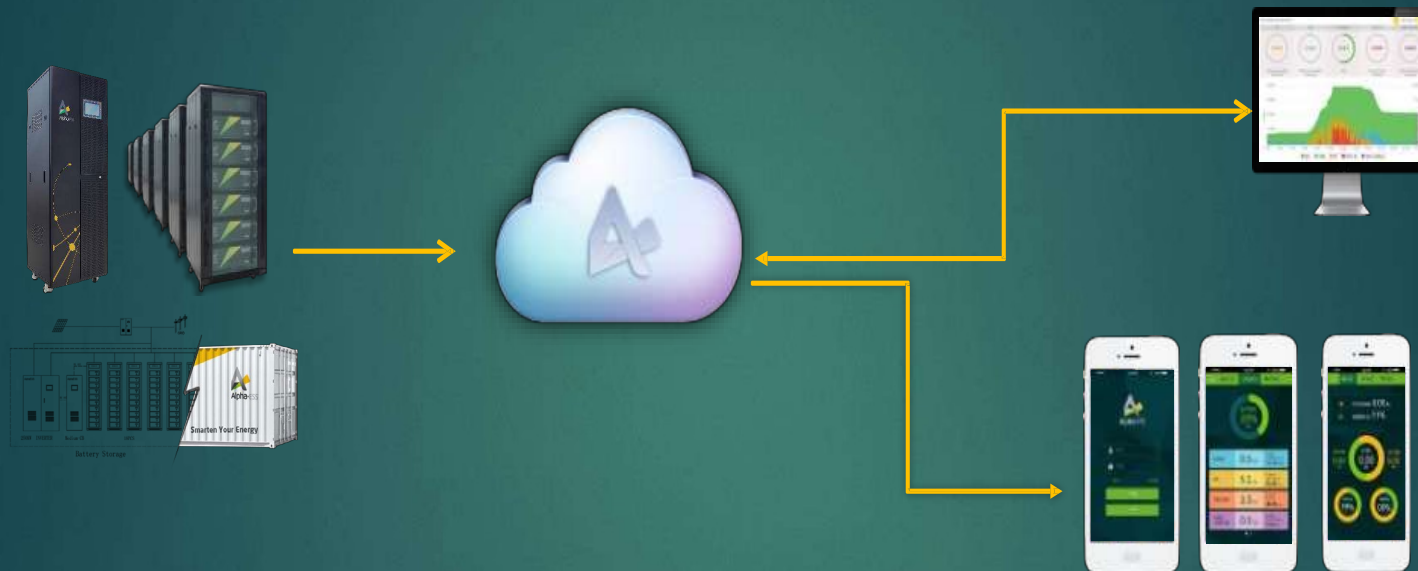


# — Smarten Your Energy —

|          |        |
|----------|--------|
| Power    | 694W   |
| Total    | 7.5kWh |
| Battery  | 100%   |
| UPS Mode |        |

# Solutions Reliability

## Remote Monitoring & Control



- Web & APP monitoring system via Alpha Cloud
- EMS & BMS firmware update by USB driver or **remotely online**
- Remote setup changes via web monitoring management account
- Future Access to super smart home and energy internet



# PART 4

## Case Studie

# Case Studies

## Australia Residential

### Background:

- High electricity rate from grid 28 cents US\$
- No incentive for solar feed-in power
- Daytime consumption around 15kWh

### ESS Solution:

- 6.5 kW PV capacity
- 1 x Storion S5
- 3 x M4860 (9 kWh) battery modules
- Installed in 2015 in Melbourne, Australia.

**Summary:** A 6.5kW PV array generates about 25 kWh of electricity every day, the happy Australian couple in the picture uses about 15 kW during the day, with the help of Alpha ESS STORION S5 they can also save the excess PV energy in the 9kWh battery bank for their night use. In this way they use approx. 90% of their total PV generation and meet 78% of their total energy consumption.



# Case Studies

## Australia Commercial - Drayton Shopping Center

### Background:

- Day peak 30kW
- Demand response from PV and battery to reduce demand charge

### ESS Solution:

- 30 kW PV capacity
- 3 x Storion S5
- 12 x M4860 (36 kWh) battery modules
- Installed in 2016 in Toowoomba, Australia.

**Summary:** A 30kW PV array generates about 130 kWh of electricity every day, the shopping center consumes them all and the battery is used to shift load and reduce demand charge. The estimation of demand charge reduction will cut 1/3 of their bill.

**The commercial sector is rapidly growing from zero in 2015, to more than 30 in 2016. We expect 200+ projects in 2017 and in much larger size.**





# Case Studies

## SEA Island solution (Philippines)

together with our Philippines partner customized solutions for 8 islands across the Philippines for an US telecommunication company with different storage solutions from **20kWh to 300kWh**, below is just one of sites info :

**Antique Island:** There is grid on island but the grid is unstable, the telecom station has 5kW essential load need to be operate stably 7x24 hours, the grid is usually fail 5 hours a day, therefore storage is needed to cover the critical loads for 2 days even there are black outs, Diesel Genset will be on automatically to charge the battery and power the load when there is no sun and battery running flat.

### **Solution:**

- 13 kW PV Panels
- 20 x M4860 battery module (60 kWh total)
- 2 x STORION S5
- Diesel Generator as Back-up when there is a (Auto Start)



# Contact information



**China:**  
**Alpha ECo., Ltd.**  
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**E-mail.** [info@alpha-ess.com](mailto:info@alpha-ess.com)  
[www.alpha-ess.com](http://www.alpha-ess.com)

**Add.** NW2, Nano  
Polis,  
Lake Avenue,  
Industria



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**Alpha ESS Europe GmbH**  
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[www.alpha-ess.com](http://www.alpha-ess.com)

**Add.** 179 namir street tel aviv  
po  
box 48466 TELAVIV 6148401



**stralia PTY. Ltd.**  
968 933  
[alia@alpha-ess.com](mailto:alia@alpha-ess.com)  
[www.alpha-ess.com/au](http://www.alpha-ess.com/au)

01 68 Mcevoy  
ST,  
SW 2015

# THANK YOU!

**SMARTEN YOU  
ENERGY**

**PRESENTED BY MILLENNIUM -ESS**



# PART 5

## BATTERY Solutions & PROPOSALS FOR IL BIG UTILITY