三相电力
SUNSHINE POWER

WUHAN SUNSHINE POWER SCIENCE&TECHNOLOGY CO.,LTD

Transmission Line Fault Warning and Diagnosis System ——SP3000

Leader in fault diagnosis for high-voltage transmission lines in China

Company Profile

Established in 2007 and located in Wuhan, Optics Valley, WUHAN SUNSHINE POWER SCIENCE&TECHNOLOGY CO.,LTD. integrates research, production, and marketing. For 17 years, as **the inventor of sp3000**, we've dedicated ourselves to the advancement of "power grid fault diagnosis and early warning technology," emerging as the **standard-setter** and **pioneer** in this sector in China.

By 2023, our products have achieved ubiquitous presence across all provinces and municipalities nationwide. Our comprehensive market share and market share in ultra-high voltage and above far exceed those of similar enterprises, establishing us as the industry leader.

Second Prize of National Science and Technology Progress Award

First Prize of China Electric Power Science and Technology Progress Award

National standard

State Grid Enterprise Standard

2010 — Solved the problem of "**fault location and identification**"; independently developed the **first-generation fault diagnosis system;** obtained several patents; major breakthroughs on distributed fault diagnosis technology.

2011 — Operated in **large-scale network in provincial level**

2012 — **Certified by CEC(China Electricity Council)** reaching the international level.

2014 — Applied to China's **AC 1000kV and DC ±800kV** network

2015 — Awarded the **Second Prize of National Scientific and Technological Progress.**

2016 — Set up **the national standards and SGCC** on distributed monitoring technology

2019 — Granted "Hubei Engineering Technology Research Center" by the Hubei Provincial Department of Science and Technology for the Intelligent Inspection and Diagnosis of Transmission Line ; Established the **Sunshien Power Science and Technology Association**; "Top 100 Software Enterprise."

2021 — The new Distributed Diagnosis System has been certified by **China Electricity Council and** operated on the ± 1100kV Jiquan line

2022 — Ranked 51st among the **2021 Top 100 High-tech Enterprises in Hubei Province;** selected as"Little Giant" Firm in Hubei .

Technical background and application scenarios

power grid

The long distance and expansive span of transmission lines present a challenge for manual inspection, which would result in lingering hazards and make it hard to pinpoint the fault causes, raising the risk of power shortages and grid accidents.

Wind and photovoltaic

Wind and solar farms cover vast land areas with diverse terrain and complex line structures. They are prone to damage from lightning, vegetation, and drifting, disrupting power supply and causing energy wastage.

rail transit

Rail transit systems navigate complex environments, crossing hills, wild fields, and rivers. faults often occur due to construction activities, fallen trees, railway vibrations, and strong electromagnetic fields, resulting in significant societal impacts.

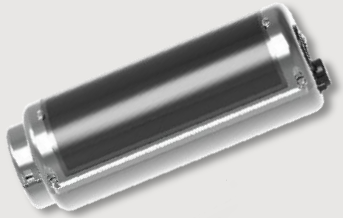
Oilfield and mining

Oil fields, coal mines, and non-ferrous metal mines face harsh working conditions and complex corridor environments. They are threatened by lightning and wildfires, consequently affecting their production output.

Our Solutions -- SP3000

MT**s are installed at multiple points** along transmission lines and cable lines to directly measure **traveling wave** and **power frequency fault currents** nearby. This enables **fault early warning, fault location, and fault cause identification**. Compatible with 10KV to 1000KV ultra-high voltage lines.

overhead line MT



cable line MT

Major Functions

90% Monitoring and early warning

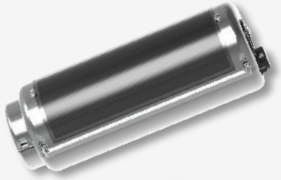
±200m (overhead line)

≤2‰ Line length (cable line) Fault location

95% lightning/non lightning identification

Product advantages

SP3000 VS Conventional fault location products

	SP3000	Distance relay
		
Positioning accuracy	±1 tower	Large error
Fault location method	Dual end traveling wave positioning; single end traveling wave positioning; Reclosing traveling wave positioning; opening traveling wave positioning	Impedance distance measurement
Diagnostic applicability	Both metallic grounding and high resistance grounding are reliable	lightning only
Line applicability	pure overhead lines; mixed over-head lines; T-connect line; Mixed T-connect linea	pure overhead lines
Additional features	Interval location; Early warning; fault cause identification; lightning characteristics monitoring	/

SP3000 configuration

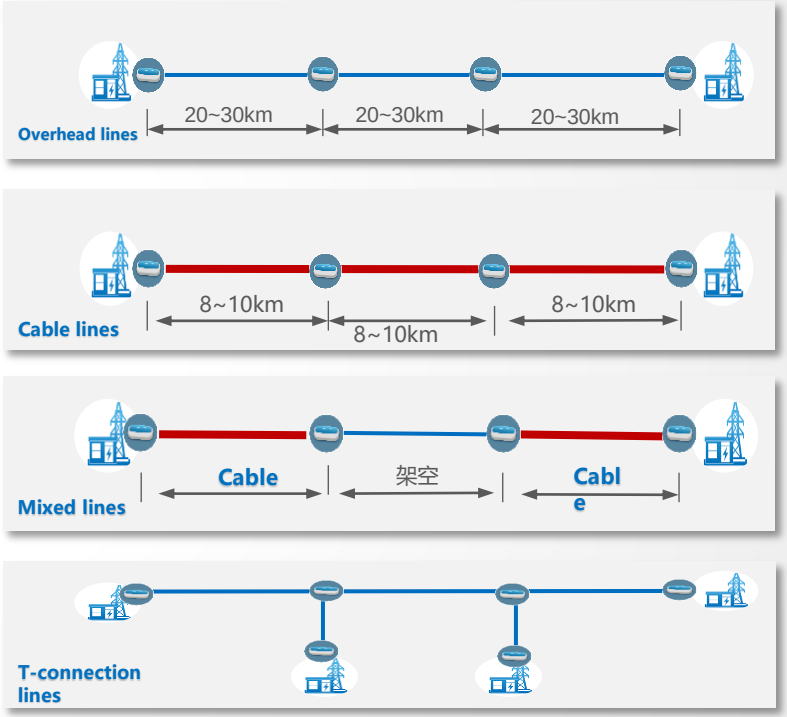
SP3000 configuration:

- **Overhead line MT**: installed in three-phase A, B, and C respectively; 3 units for 1 set
- **Cable line MT**: 1 data acquisition unit and 9 sensors

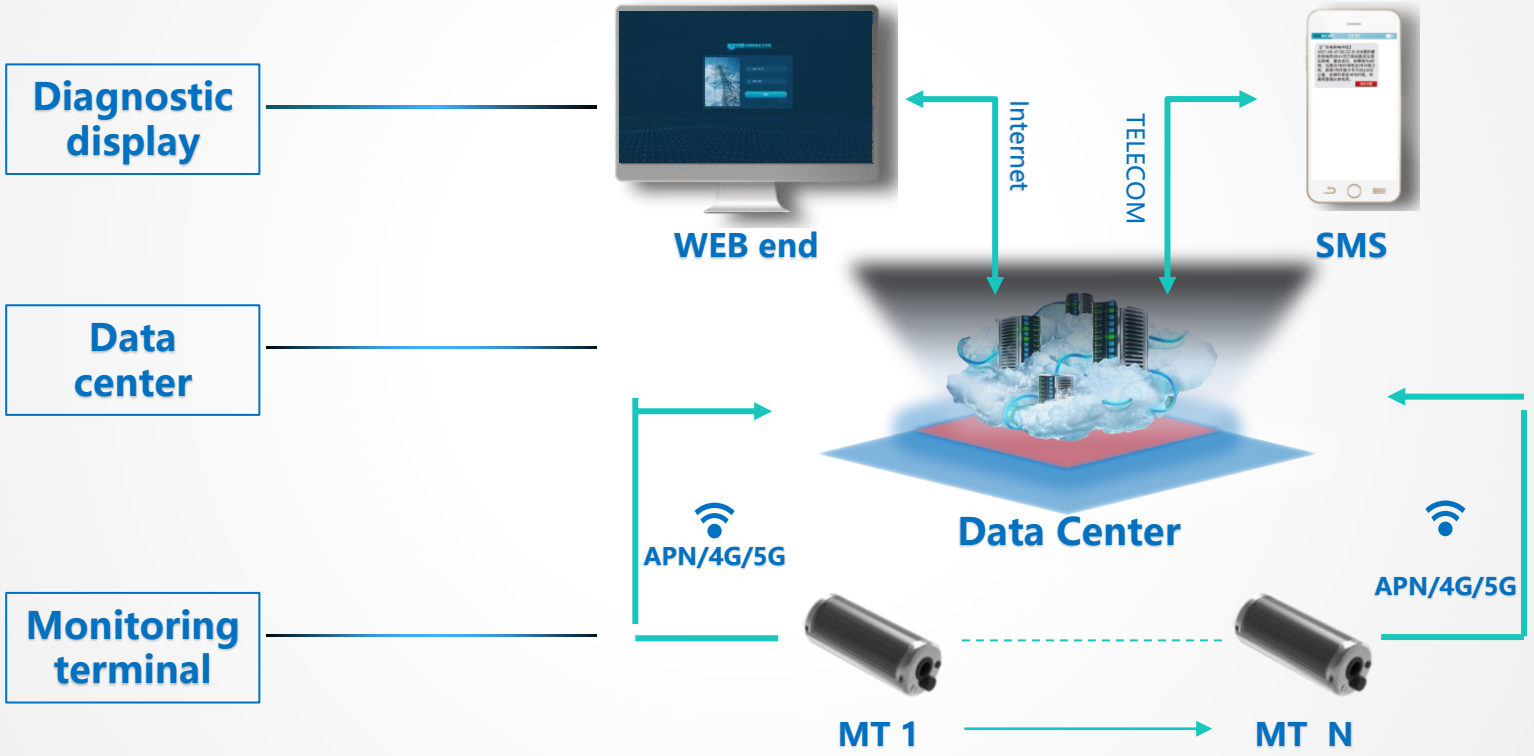
Line deployment :

- **Overhead lines**: For overhead lines within 30 kilometers, one set of device is installed at each end; one set added every 30 kilometers
- **Cable lines**: For cable lines within 10 kilometers, one set of device is installed at each end; one set added every 10 kilometers.

For long branches (2km and above), one set of equipment is added at the branch end; for short branches, installation is selective based on specific needs.



SP3000 Structure



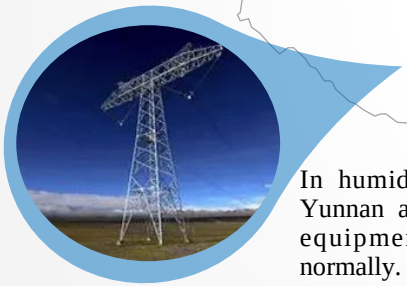
SP3000 Anti-interference:

Overhead line MT protection grade: IP67;
Cable line MT protection grade: IP68;
Suitable for diverse environments: extreme cold, **high temperatures, high humidity, high altitudes, and high salt fog**. Seismic resistance verified in areas with frequent strong winds.

Sunshine Power

In Northwest's high-temperature areas, equipment operates normally at 40℃.

In extremely cold northern regions, equipment operates normally at -40℃.



In humid regions of Yunnan and Guizhou, equipment operates normally.

In Qinghai-Tibet's high-altitude areas above 5000 meters; atmospheric pressure ＜58 kPa, equipment operates normally.

In coastal high-salt-fog areas, equipment operates normally.

In regions with frequent strong winds, equipment operates normally.

Overview of Application of Power Grid in China
(Data as of 2023)

Since 2012, China State Grid and Southern Power Grid（Two major Chinese power grids） have prioritized diagnosing transmission line faults, leading to widespread use of distributed fault diagnosis systems. By the end of 2023, over **80,000** MTs had been installed by these two companies, covering more than 900,000 kilometers of lines and diagnosing over 11,000 faults successfully.




Partial Application in China - Ultra High Voltage DC Lines

Provinces of the route	Voltage level	Line name	Application time
Xinjiang, Gansu, Ningxia, Shaanxi, Henan, Anhui	±1100kV	Jiquan Line	2020-10-18
Xinjiang, Gansu, Ningxia, Shaanxi, Shanxi, Henan	±800kV	Tianzhong Line	2016-09-28
Gansu、Shaanxi, Chongqing, Hubei, Hunan	±800kV	Qi Shao Line	2023-05-17
Inner Mongolia、Hebei, Tianjin, Shandong, Jiangsu	±800kV	Xitai Line	2018-09-03
Inner Mongolia, Shaanxi, Shanxi, Henan, Hebei, Shandong	±800kV	Zhaoyi Line	2017-12-05
Sichuan, Chongqing, Hubei, Hunan, Anhui, Zhejiang, Jiangsu, Shanghai	±800kV	Fufeng Line	2019-03-16
Ningxia, Shaanxi, Shanxi, Henan, Anhui, Zhejiang	±800kV	Lingshao Line	2018-10-05
Shanxi, Hebei, Henan, Shandong, Anhui, Jiangsu	±800kV	Yanhuai Line	2019-06-09
Sichuan, Guizhou, Hunan, Jiangxi, Zhejiang	±800kV	Binjin Line	2021-03-21
Sichuan, Yunnan, Chongqing, Hunan, Hubei, Anhui, Zhejiang, Jiangsu	±800kV	Jinsu Line	2017-04-16
Sichuan, Yunnan, Guizhou, Hunan, Jiangxi	±800kV	Yahu Line	2024-04-19
Sichuan, Chongqing, Hubei, Anhui, Jiangsu	±800kV	Jiansu Line	2024-04-12
Shaanxi, Shanxi, Henan, Hubei	±800kV	Shaanwu Line	2021-06-09
Sichuan, Chongqing, Hubei, Anhui, Zhejiang	±800kV	Jintang Line	2022-09-07
Yunnan, Guizhou, Guangxi, Guangdong	±800kV	Liulong DC Line	2022-02-27
. . .	. . .	. . .	. . .

Partial Application in China - Ultra High Voltage AC Lines

Line unit	Line name	Voltage level	Installation time
SGCC	Yuwu Line II	1000kV	2023-08-13
SGCC	Yuwu Line I	1000kV	2023-08-13
SGCC	Xiaojiang Line I	1000kV	2021-12-08
SGCC	Xiaojiang Line II	1000kV	2021-12-08
SGCC	Jianglian Line II	1000kV	2021-10-21
SGCC	Hequan Line I	1000kV	2021-04-30
SGCC	Antang Line I	1000kV	2020-10-11
SGCC	Ehong Line I	1000kV	2020-08-21
SGCC	Ehong Line II	1000kV	2020-08-21
SGCC	Antang Line II	1000kV	2020-05-26
SGCC	Wutang Line II	1000kV	2020-01-14
SGCC	Caohu Line I	1000kV	2019-11-06
SGCC	Caohu Line II	1000kV	2019-11-06
SGCC	Changnan Line I	1000kV	2019-09-28
SGCC	WutangLine I	1000kV	2019-09-18
SGCC	Yigao Line I	1000kV	2019-09-11
SGCC	Hugao Line I	1000kV	2019-9-26
SGCC	Hugao Line II	1000kV	2019-9-26
SGCC	Yigao Line II	1000kV	2019-09-11
SGCC	Tai Wu Line I	1000kV	2019-07-26
SGCC	Tai Wu Line II	1000kV	2019-07-26

Line unit	Line name	Voltage level	Installation time
SGCC	Nanjing Line I	1000kV	2018-09-11
SGCC	Shengxi Line I	1000kV	2018-09-03
SGCC	Shengxi Line II	1000kV	2018-09-03
SGCC	YueDing Line II	1000kV	2018-06-12
SGCC	Yue Ding Line I	1000kV	2018-06-11
SGCC	Eyue Line I	1000kV	2018-06-10
SGCC	Eyue Line II	1000kV	2018-06-10
SGCC	Dinghe Line I	1000kV	2018-06-08
SGCC	Dinghe Line II	1000kV	2018-06-08
SGCC	Anlan Line II	1000kV	2018-04-11
SGCC	Anlan Line I	1000kV	2018-01-12
SGCC	Jianglian Line I	1000kV	2017-06-14
SGCC	Xilang Line II	1000kV	2017-03-18
SGCC	Xilang Line I	1000kV	2017-03-17
SGCC	Huaixu Line I	1000kV	2017-01-17
SGCC	Huaixu Line II	1000kV	2017-01-17
SGCC	Xu Tai Line I	1000kV	2017-01-16
SGCC	Xu Tai Line II	1000kV	2017-01-15
SGCC	Hu'an Line I	1000kV	2016-10-21
SGCC	Hu'an Line II	1000kV	2016-09-21
SGCC	Du Rong Line II	1000kV	2014-11-11
. . .	. . .	. . .	. . .

Application overview in China - Wind & Photovoltaic Power
(Data as of February 2024)

This system is widely adopted in wind farms and solar stations of the Top 5 Power Provider Groups in China and so on . Over **120** new energy stations have implemented it, with **809** sets of equipment installed, monitoring **302** lines. It has successfully diagnosed **381** faults, achieving a fault diagnosis success rate of over **91.3%**.

This system enhances collection line perception, supporting smart monitoring and maintenance. Additionally, It provides scientific guidance for line safety and protection measures.

Partial Application in China - New Energy Stations

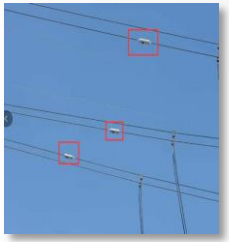
Enterprise	Owners	Station name	Line name	Application time
国家能源集团 CHN ENERGY	CHN ENERGY	Ningxia Qiuqu No.4 Wind Farm	Longma Line II	2023-4-25
中国华能 CHINA HUANENG	CHINA HUANENG	Jieshan Wind Farm	collection Line III	2022-9-9
中国华电 CHD	CHD	Shilao He Wind Farm	Shilao He collection Line II	2023-9-4
大唐集团公司 CHINA DATANG	CHINA DATANG	Tang Xing Wind Farm	Tang You Line	2023-7-11
国家电投 SPIC	SPIC	Longchang Wind Farm	Longchang collection ALine	2023-10-28
中广核 CGN	CGN	Yuanfeng Wind Farm	Yuanfeng Line IV	2022-6-15
華潤電力 CR POWER	CP POWER	Guguan Wind Farm	Gulong Line	2022-12-22

Enterprise	Owners	Station name	Line name	Application time
SDIC 国投电力	SDIC	Lechengshan Wind Farm	Lechengshan Wind Farm phase II collection Line II	2022-9-16
HuaiNan 淮南矿业	HUAINAN MINING INDUSTRY	Dingji Mine	Dingji Mine 775Line	2023-6-9
中国节能	China Energy Conservation and Environmental Protection Group	Heyeping Wind Farm	Heyeping Line I	2023-6-27
湖北能源	Hubei Energy	Qiyue Mountain Wind Farm	Qiyue Mountain collection Line II	2022-9-24
TISCO	TISCO	TISCO Technical Center Technical Renovation Spare Parts Project	13 # Vacuum power transformer feeder cabinet	2024-1-9
. . .	. . .	. . .	. . .	. . .

Overseas application - Malaysia & Laos

Malaysia

In July 2020, four sets of the devices were installed on the **275kV BTRK-TPAH line, spanning 90,858 meters** under the **Malaysian Power Research Institute's** jurisdiction. In August 2020, A line fault trip was successfully monitored and accurately located.



Laos

In December 2023, two sets of the devices were installed on the **115kV MuangNga TS-PMO2-Nam Ngum 5-Vang Vieng single loop (31,256 meters long) and the MuangNga TS-PMO2**, both managed by **the Laos National Power Transmission Company**. In April 2024, A line fault trip was successfully monitored and precisely located.

••• •••

Economic Benefits SP3000 --Power grid transmission lines

Scenario Assumption: A 220kV transmission line, 60MW average power, 90km, with an electricity price of $0.07/kWh.
The line experiences 1 short circuits annually, with 10 inspectors costing $10 each.

Cost of SP3000 in this scenario: $160,000 (4 sets, unit price: $40,000/set).

A - Reduced outage time

$147,000 = 1 short circuit/year * 60,000kW * 35h * $0.07/kWh

The fault positioning feature of the SP3000 reduces annual outage time for a single line by about 35 hours. (calculated based on one permanent fault per year with an average outage reduction of 35 hours per incident.).

B – Shortened manual inspection time

$3,500 = 1 short circuit/year * 10 people * 35h * $10/people/h

SP3000 system reduces the time and resources needed for manual fault location after a line failure. calculated based on a line that trips once per year; each incident saves about 35 hours of search time with 10 personnel involved; $10/ hour including vehicle and equipment expenses.

C - Reduced fault trip rate

$176,300 =1short circuit/year * 60,000kW * (35+6h) * $0.07/kWh
+1short circuit/year * 10 people * (35+6h) * $10/people/h

After one year of SP3000 system implementation, targeted protective measures by the management department can reduce line trip frequency from 2 times annually to once annually. Hazard warnings decrease outage duration by 35 hours per occurrence and prevent approximately 6 hours of unplanned outage maintenance per incident.

D - Reduce Line Improvement Costs

$27,000 = 90km*$30,000/100km

The system automatically identifies lightning locations and conducts interval analysis. This enables targeted protective measures by the operations department, saving an estimated $30,000 annually per 100 kilometers of line,(This benefit is estimated after three years of project investment).

Cost savings over 5 years:
5A+5B+4C+D = $1,484,700

ROI in this scenario:
$1,484,700/$160,000=928%

Economic Benefits SP3000 --New energy station transmission line

Scenario Assumption: A 110kV New energy wind farm/photovoltaic station transmission lines, 100MW capacity, 30MW average power, 20km, with a feed-in tariffs of $0.07/kWh.

Application cost of SP3000 in this scenario:$80,000 (2 sets, unit price: $40,000/set).

A - Reduced outage time

$73500=1 trip/year * 30000kW * 35h * $0.07/kWh

The fault positioning feature of the SP3000 reduces annual outage time for a single line by about 35 hours. (calculated based on one permanent fault per year with an average outage reduction of 35 hours per incident.).

B – Shortened manual inspection time

$3500=1 trip per year * 10 people * 35h * $10/people/h

SP3000 system reduces the time and resources needed for manual fault location after a line failure. calculated based on a line that trips once per year; each incident saves about 35 hours of search time with 10 personnel involved; $10/ hour including vehicle and equipment expenses.

C - Reduced fault trip rate

$90200=1 trip/year * 30000kW * (35+6h) * $0.07/kWh+1 trip/year * 10people * (35+6h) * $10/people/h

After one year of SP3000 system implementation, targeted protective measures by the management department can reduce line trip frequency from 2 times annually to once annually. Hazard warnings decrease outage duration by 35 hours per occurrence and prevent approximately 6 hours of unplanned outage maintenance per incident.

D - Reduce Line Improvement Costs

$6,000 = 20km * $30,000/100km

The system automatically identifies abnormal discharges and conducts interval analysis. This enables targeted protective measures by the operations department, saving an estimated $30,000 annually per 100 kilometers of line,(This benefit is estimated after three years of project investment).

Cost savings over 5 years = 5A+5B+4C+D =$751,800

ROI in this scenario $751,800/$80,000=940%

Economic Benefits SP3000 --New energy cable collection line

Scenario Assumption: A 35kV Cable collection lines for new energy wind farms/photovoltaic stations, 25MW design capacity for a single collection line , 7.5MW average power, 20km, with a feed-in tariffs of $0.07/kWh.

Application cost of SP3000 in this scenario:$80,000 (2 sets, unit price: $40,000/set).

A - Reduced outage time

$36750=2 trips/year * 7500kW * 35h * $0.07/kWh

The fault positioning feature of the SP3000 reduces annual outage time for a single line by about 35 hours. (calculated based on 2 permanent fault per year with an average outage reduction of 35 hours per incident.).

B – Shortened manual inspection time

$7000=2 trips per year * 10 people * 35h * $10/people/h

SP3000 system reduces the time and resources needed for manual fault location after a line failure. calculated based on a line that trips 2 times per year; each incident saves about 35 hours of search time with 10 personnel involved; $10/ hour including vehicle and equipment expenses.

C - Reduced fault trip rate

$25625=1 trip/year * 7500kW * (35+6h) * $0.07/kWh+1 trip/year * 10people * (35+6h) * $10/people/h

After one year of SP3000 system implementation, targeted protective measures by the management department can reduce line trip frequency from 3 times annually to 2 annually. Hazard warnings decrease outage duration by 35 hours per occurrence and prevent approximately 6 hours of unplanned outage maintenance per incident.

D - Reduce Line Improvement Costs

$6,000 = 20km * $30,000/100km

The system automatically identifies abnormal discharges and conducts interval analysis. This enables targeted protective measures by the operations department, saving an estimated $30,000 annually per 100 kilometers of line,(This benefit is estimated after three years of project investment).

Cost savings over 5 years
5A+5B+4C+D = $327,250

ROI in this scenario
$327,250/$80,000=409%

WUHAN SUNSHINE POWER SCIENCE&TECHNOLOGY CO.,LTD

THANKS

Contact number： 0086 -027-87420702

E-mail：zhangheng@sunshine-power.net

Website：www.sunshine-power.net