



Joint International Business Group

New Energy Enterprise Cooperation Plan

JIBG

New Energy Industrial Park Planning Project :

New Energy Industrial Park

Project	Area	Total capacity(MW)
CIGS Solar cells and modules	Sub Sahara	30

The 30 MW CIGS solar cells and modules produced by New Energy Industrial Park cells can be widely used in agriculture, industry, transportation, education and construction.

※ Total capacity can be expanded to 300MW(10 production lines) according to demand.

New Energy Plan Summary

Benefits :

- Lead the development of new energy industries and attract other technology industries to invest; thus, increase the economic value of new energy industries.
- Increase employment opportunities and economic value.
- Enhance economic development and the construction of new energy model; promote prosperity, environmental protection and increase business opportunities.
- Implement nation's new energy policy; reduce carbon emission

• Environment Benefit :

Project	Number	Unit
Reduction CO ₂ Emission	22,851.8	Tonne
CO ₂ Reductions of Forest Area	2.23	km ²



Cases of Domestic and Foreign Solar Power Project

Power Engineering Business

- **Solar Power System**
 - On Grid Solar Power System
 - Stand-alone Solar Power System
 - Building-Integrated Photovoltaic (BIPV)
- **Bio Gas**
 - Biogas Power Generation System
 - Biodiesel Energy Systems
 - Biomass Energy Systems of Alcohol
- **Hybrid System**
 - By solar - biomass and wind - Renewable energy combined with each other or combination of a common integrated power system

CIGS Solar Power Plant Actual Case



Solar Frontier modules in La Rioja, Spain

Photograph: Solar Frontier

Spain CIGS Solar Power Plant

CIGS Solar Power Plant Actual Case



U.S. First
Solar, Nevada, (300MW)



U.S. First Solar, Mongolia (2000MW)

CIGS Solar Power Plant Actual Case



U.S. First Solar, New Mexico (30MW)

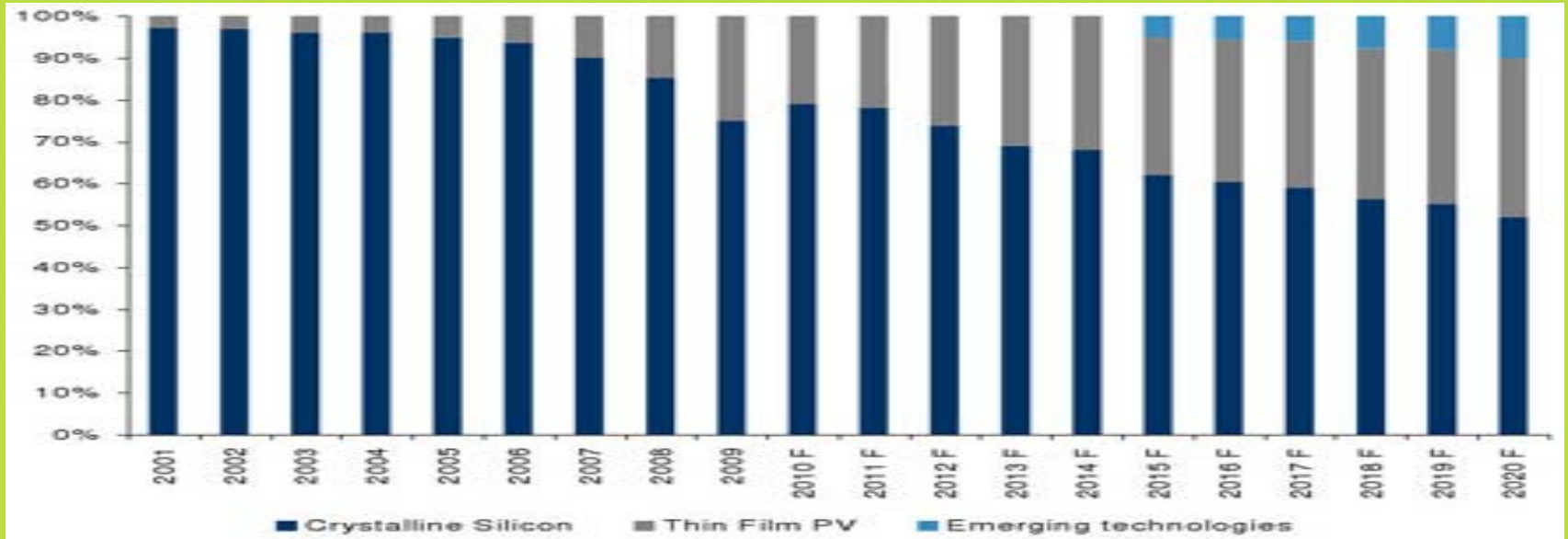


U.S. First Solar, Spain (50MW)

Advantage Analysis and Application in Thin Film Solar

Global Thin Film Solar Market Outlook

2001-2020 forecast solar technology market share (in module production basis)



Source : GBI Research, F-Forecast

- During 2007~2010, the average annual growth rate of thin film solar cells is 60.5%, which is higher than that of overall solar cell(40%).
- In 2010, annual production of thin-film solar cells has reached 27gigawatts and market share has reached 13.5%. Market share is expected to increase year by year; the trend will not slow down by 2020.

Cost Analysis: Thin-Film Solar Modules Per Watt (CdTe)

First Solar stated that the production cost of cadmium telluride (CdTe) thin film solar module will be \$0.52 to \$0.63 per watt by 2014.

Conclusion:
Based on last year's data, First Solar's production cost has decreased 13% to 75 cents per watt in 4Q.

(CdTe) Thin-Film Average Cost of Production	
2006y	\$1.40/Watt
2007y	\$1.23/Watt
2008y	\$1.08/Watt
2009y	\$0.87/Watt
2010y	\$0.77/Watt
2010y4Q	\$0.75/Watt

Source : First Solar, DigiTimes, PV TECH

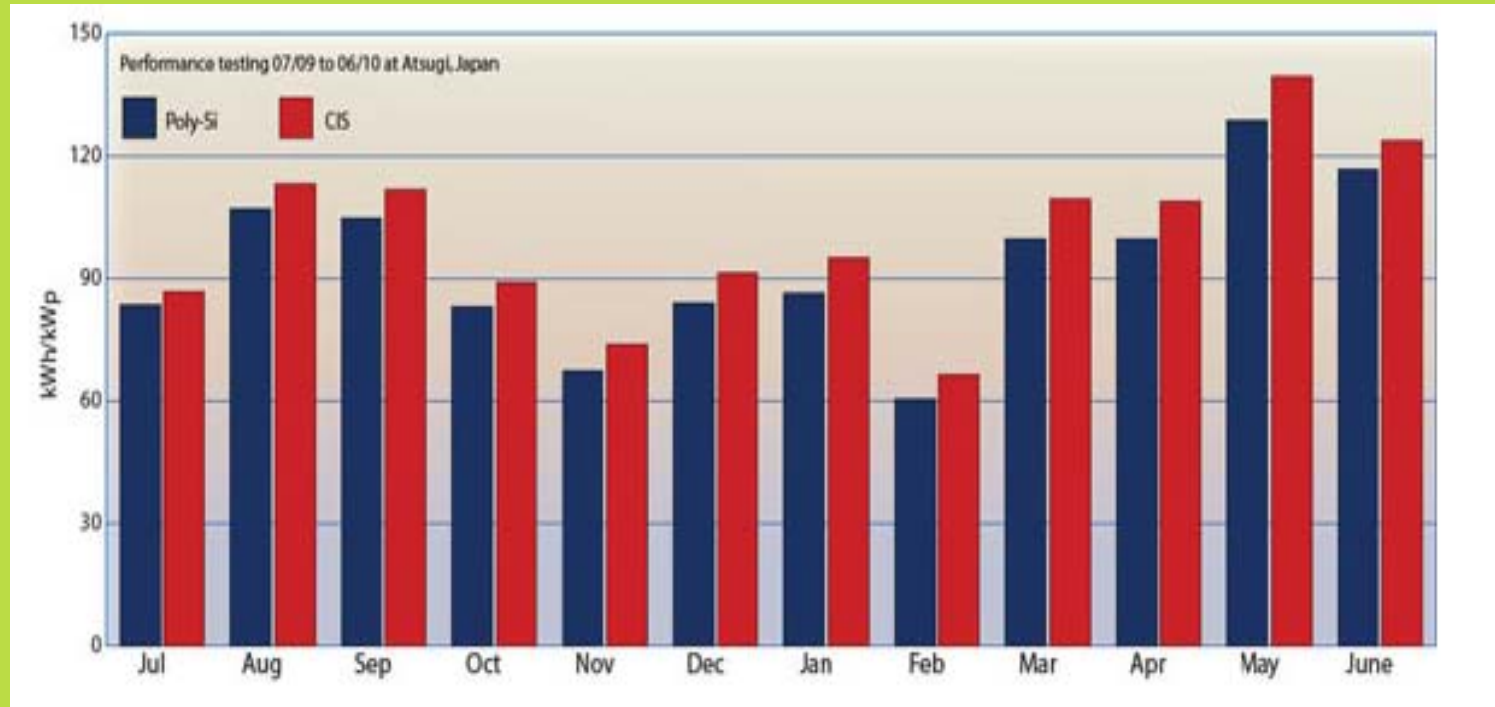
Advantages of CIGS Thin Film Solar Energy Development

1. CIGS, the most efficient semiconductor material, can work in the condition of 100 watt/m² that makes it the most potential technology in terms of cost.
2. CIGS generates 1.15-1.3 more power compared to crystalline silicon PV system.
3. CIGS is very flexible. Light intensity and angle of greater flexibility, which is cloudy and sunny in the power generation efficiency that is similar to the angle of deviation of the power generation installed capacity of silicon than crystalline solar panels small.
4. Crystalline silicon solar light failure or deterioration of the properties of light, which decline of power generation efficiency, CIGS power and high stability, power plant maintenance costs low.

Advantages of CIGS Thin Film Solar Energy Development

5. CIGS outperforms crystalline silicon solar modules with the same power ratings in real-world environments
6. Payback period: thin-film solar 1-2 years; crystalline silicon solar 2-4 years
7. Lower production costs. NREL predicts the conversion rate of solar energy continues to improve in the future. If crystalline silicon's efficiency rate reached 20%, while CIGS module efficiency rate reached 16%, CIGS's production cost would be 65% of crystalline silicon's production cost.
8. Compared to CdTe, CIGS does not pollute the environment and there is no shortage of raw material reserves (tellurium)

Winner of Solar Energy Technology : CIGS

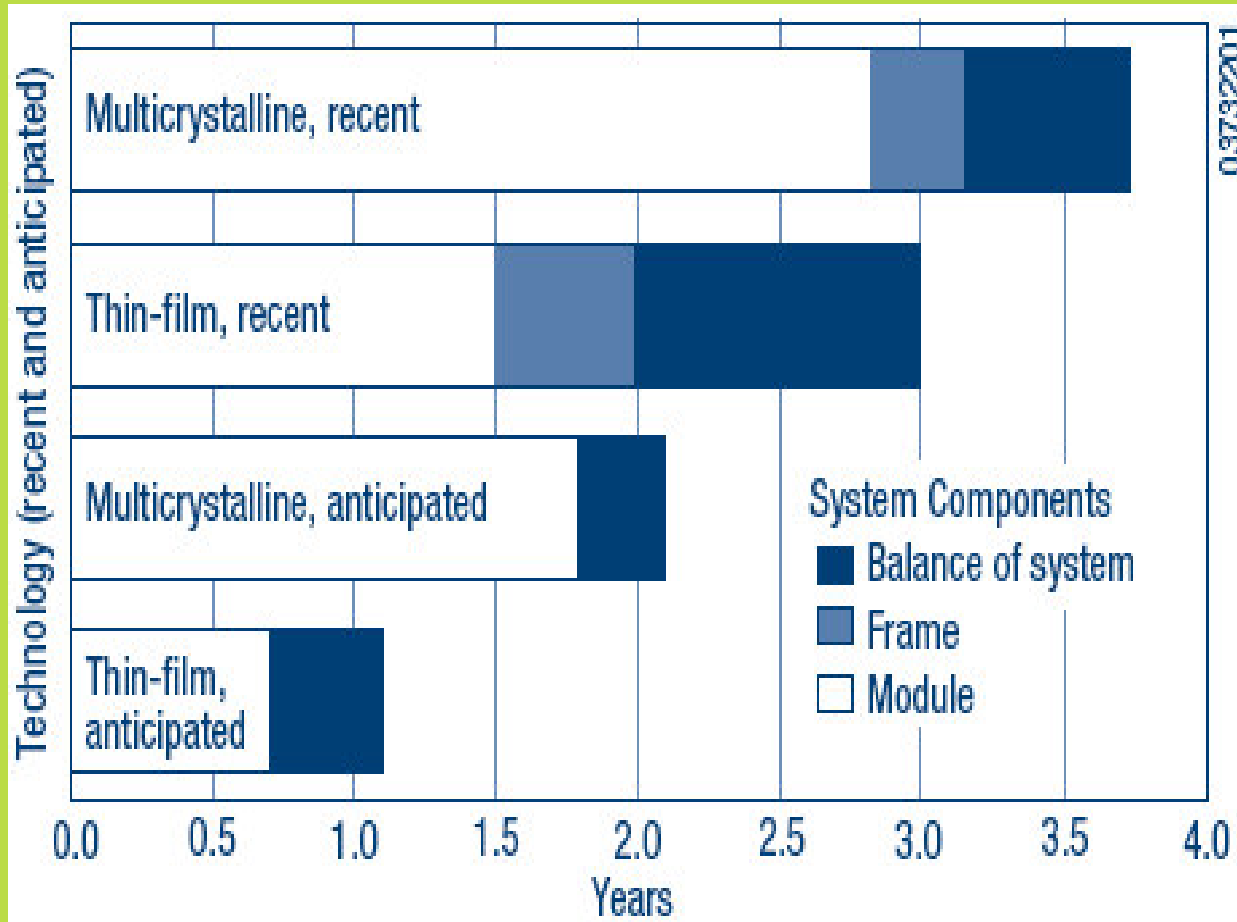


Source: Japan Showa Petroleum Institute

Since CIGS has very high efficiency, it can even generate power under weak conditions such as at sunrise and sunset.

According to Japanese experiment, CIGS (red) generates more power than Poly-Si (blue) in every season.

Solar Energy Technology-Return on Investment

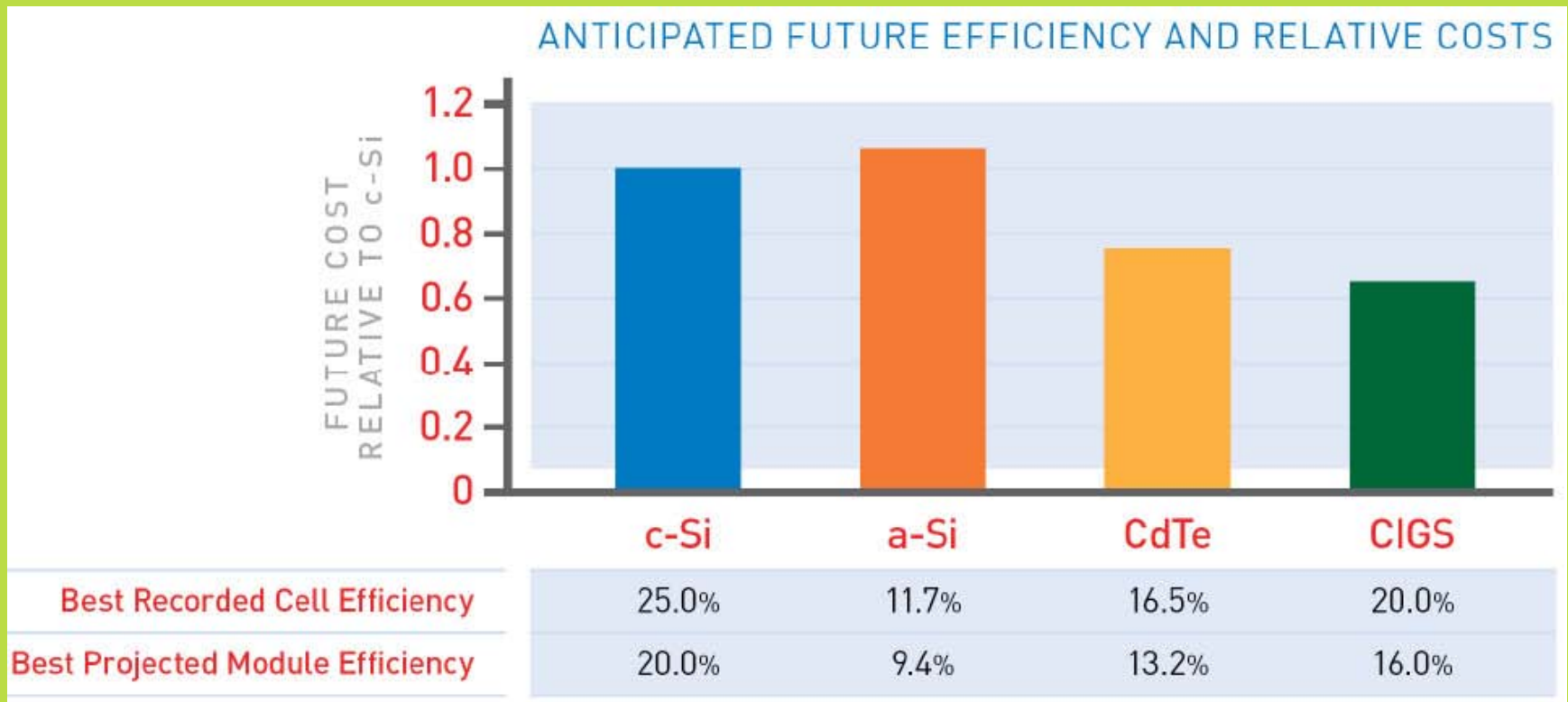


Source : NREL

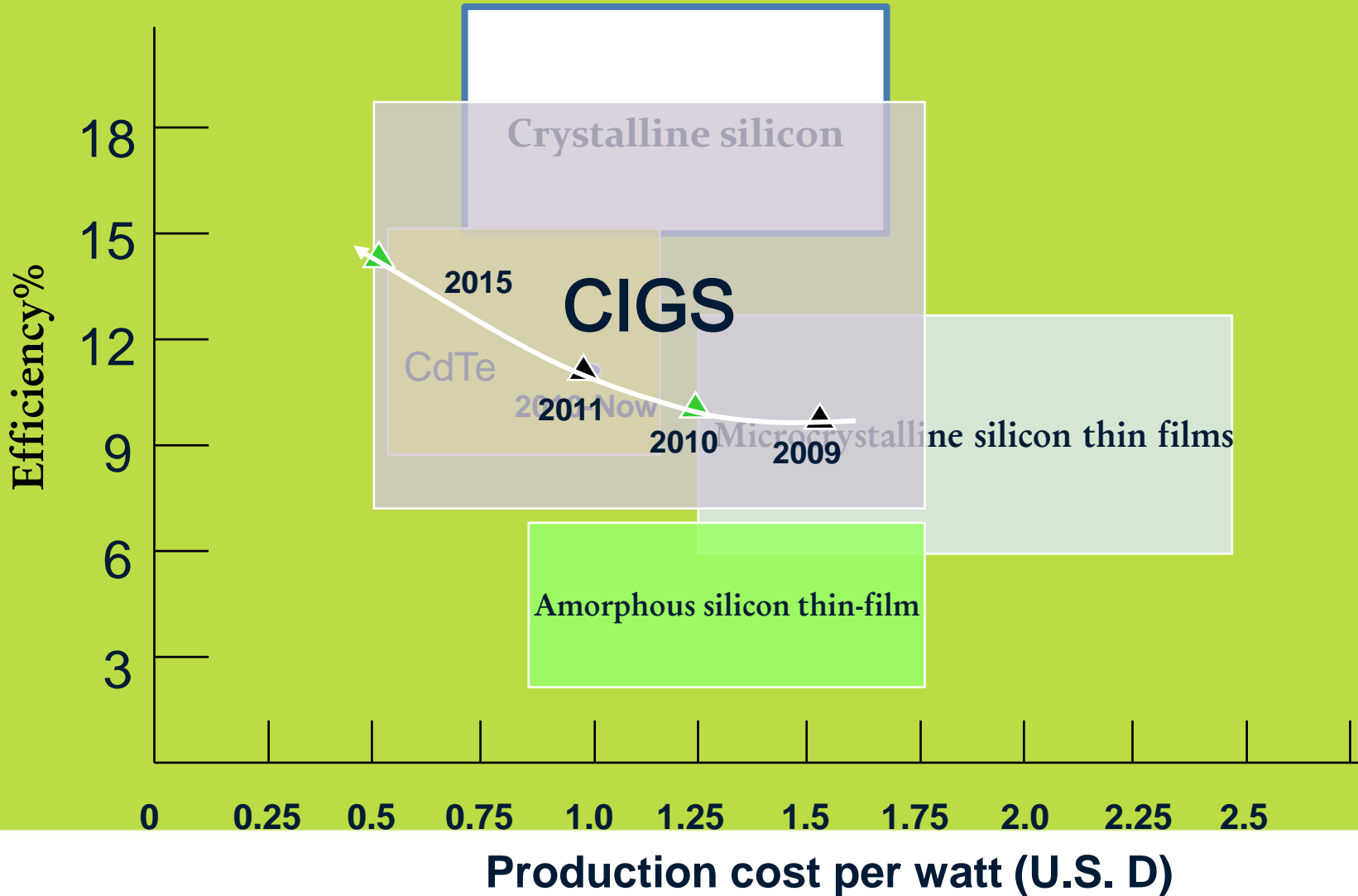
- In the condition that the amount of sunshine is 1,700 kWh per square foot, thin-film solar modules' average payback period can be reduced to 0.65 years; The payback period of Solar energy system composed by thin-film solar modules is less than 1.5 years.
- The payback period of Polycrystalline silicon is 3 years. The payback period of Polycrystalline solar system is 3.5 years.

Winner of Solar Energy Technology : CIGS

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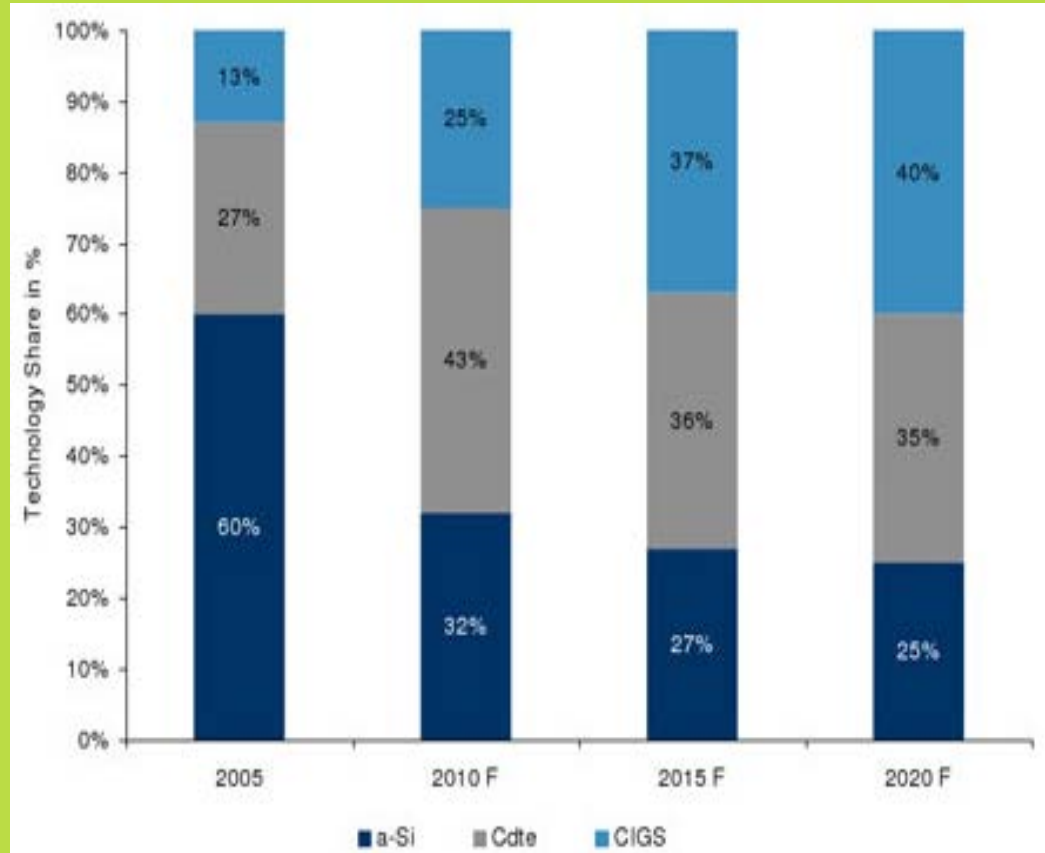


Winner of Solar Energy Technology : CIGS



Winner of Solar Energy Technology : CIGS

- According to professional organization's report, thin-film solar- CIGS PV's market share will exceed CdTe's market share in 2015; thus, represents 15% of the total PV market share.



Source : GBI Research, F-Forecast

CIGS Thin Film Solar Product Applications

1. Can be used in the roof, power plants and buildings.
2. Can be a translucent, beautiful appearance, as BIPV, building a low-carbon, low-carbon communities, low-carbon buildings, low-carbon ship.
3. Can be made into soft board. the future, it is development of portable power devices for personal use, that can address the current shortage of 3C products of battery life issues.

CIGS Thin Film Solar Product Applications

Can be used in:

- solar LED lights, solar water heaters, building glass curtain, desert types of electronic systems, rivers, lakes and solar systems; solar-powered car system; solar agricultural greenhouses and solar plant factory; solar clothes; solar portable package.

New Energy Development Park Capacity Plan

- CIGS Modules: Annual capacity is about 30MW for 1 line

Project	Number (line)	Capacity (MW)
30MW CIGS solar cells and modules	1	30
Cumulative production	--	30
Estimated capacity in six years – accumulated total capacity	10	300

Accumulated capacity will reach 300MW in 6 years. CIGS can be used in agriculture, transportation, education, and constructions.

Land and Factories

One 30MW CIGS module production line requires:

Land: 1 hectare

Water :

- Mainly used for glass substrate cleaning and chemical bath process.
- Also, used for cooling and daily life, which is estimated to be 100 liters / person-day.
- Water usage for daily life is estimated to be 12.2 cubic meters/day for an increase of 125 workers. About 636,000 cubic meters of water is required for a year.

Power :

- 380/220V power supply (voltage fluctuations could not exceed $\pm 5\%$ of voltage)
- $50 \pm 0.5\text{Hz}$ power frequency
- Stable power supply
- By the local power supply bureau 110kV line into the park power distribution panel, distribution panel to divert them to the workshop by the transformation and distribution room, power distribution voltage of 380/220V.

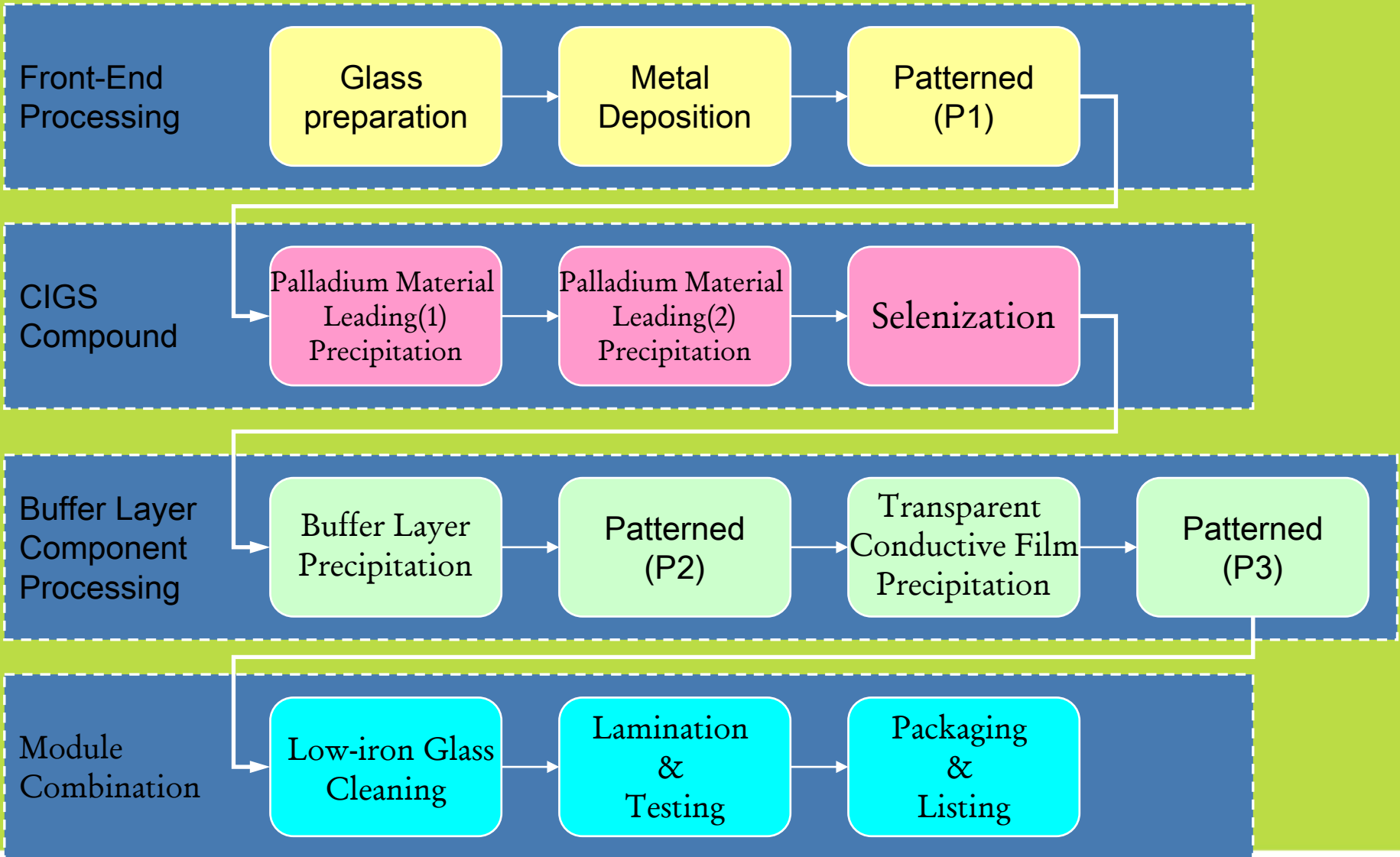
Project Equipment

30MW CIGS Solar Module Production Equipment:

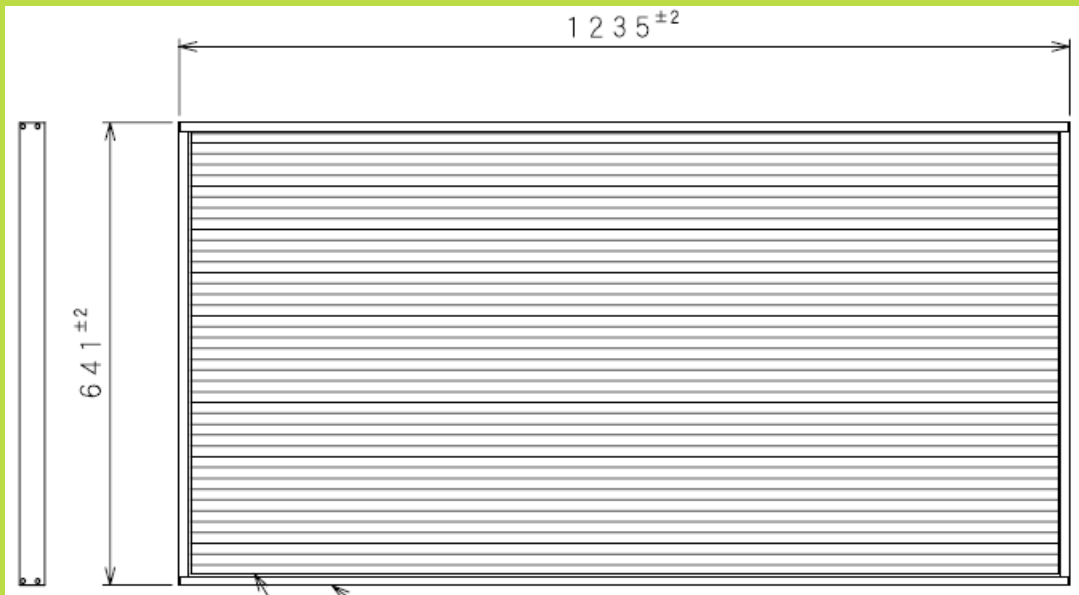
CIGS Cell Line		
	Machine name	Machine Quatity
1	Dense unpicker	1
2	Laser Marker	1
3	Glass Grinder	1
4	Initial Cleaner	1
5	Sputter (SiO ₂ /Mo)	1
6	Laser Scriber P1	2
7	Sputter (Precursor Ga/Cu-In)	1
8	Selenization Furnace	2
9	CBD(ZnS)	1
10	Mechanical Scriber P2	2
11	MOCVD (ZnO)	3
12	Mechanical Scriber P3	2
13	Edging cleaner	1
14	Cell IV tester	1
15	Automation	1

CIGS Module Line		
	Machine name	Machine Quatity
1	Back glass cleaner	1
2	Welder	2
3	Layup station	2
4	Laminator	2
5	Edge Trimmer	2
6	Junction Box assembling station	2
7	Junction Box Welder	2
8	Module IV Tester	2
9	Pour sealing machine	2
10	Edge sealing machine	2

Solar Energy Technology Process



Product Design



Synergy

8.

Project	Number
Reduce carbon dioxide emissions	22,851.8 Tonne
Reduced nitrogen compounds, sulfur compounds, the amount of dust emissions	390.9 Tonne
Reduce the amount of oil	8,476 Kiloliter
Carbon dioxide reductions of forest area	2.2 km ²
Reduce the use of coal	12,459.8 Tonne

Reducing “Global Warming” Solving “Energy Shortage”

For more information please contact:
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