Jolywood n-TOPCon solar Technology in mass production and investment capacity in Indonesia

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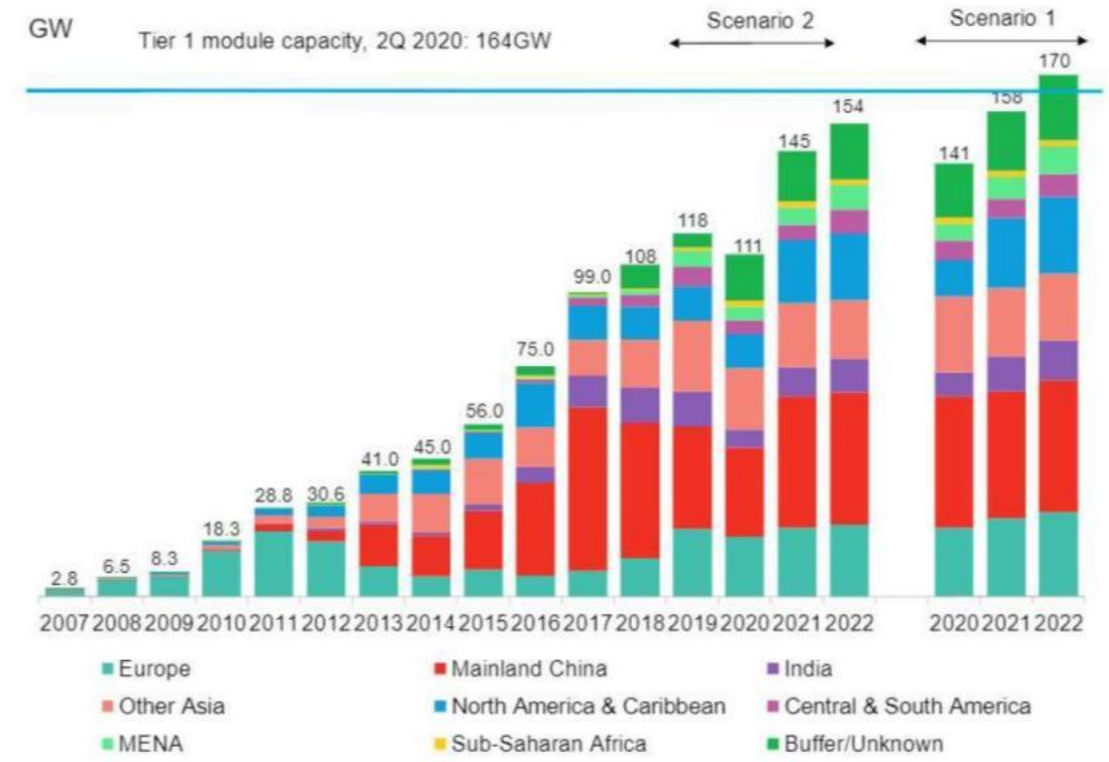
Jolywood (Taizhou) Solar Technology Co., Ltd.

2021.05.25

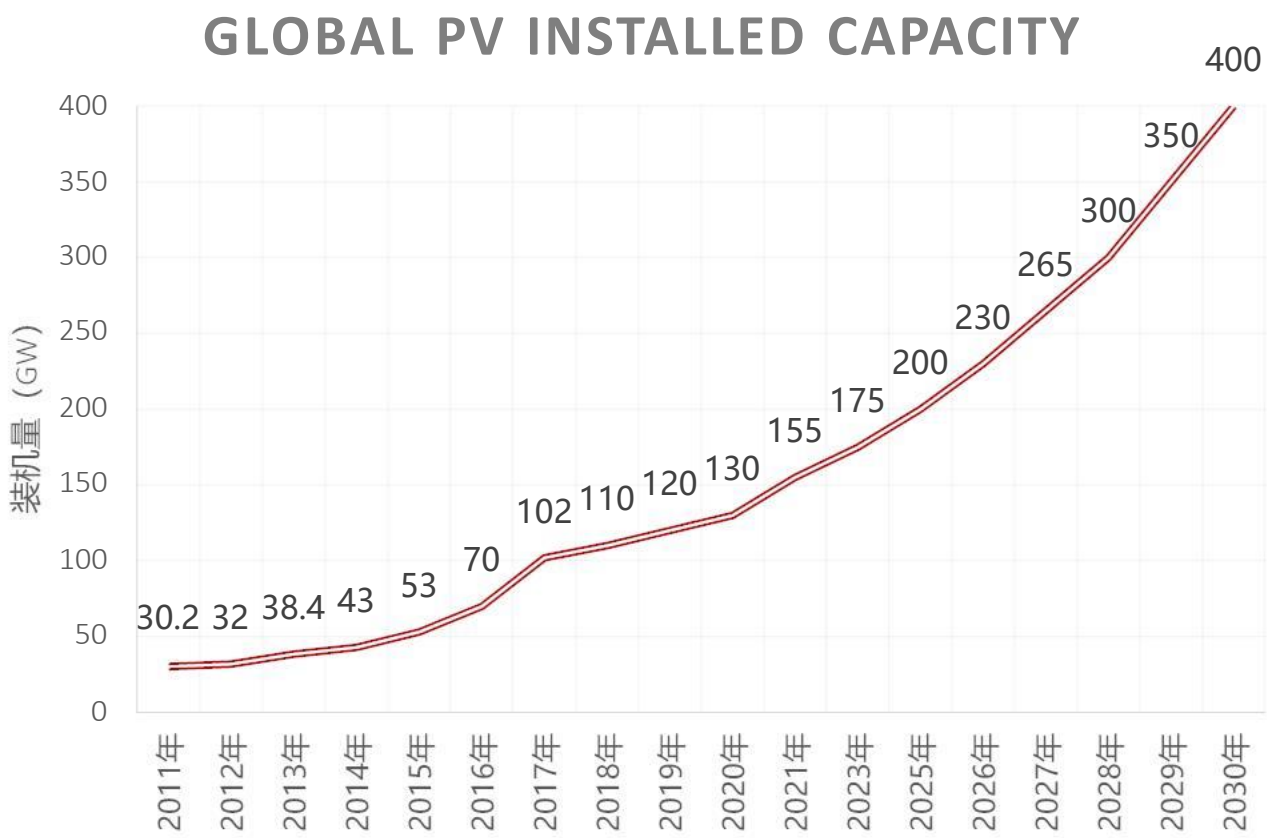
CONTENTS

Global PV market development trend

PV installed capacity continues to grow



Source: BloombergNEF. Note: Full, updated data here. For Scenarios description, see Appendix D.

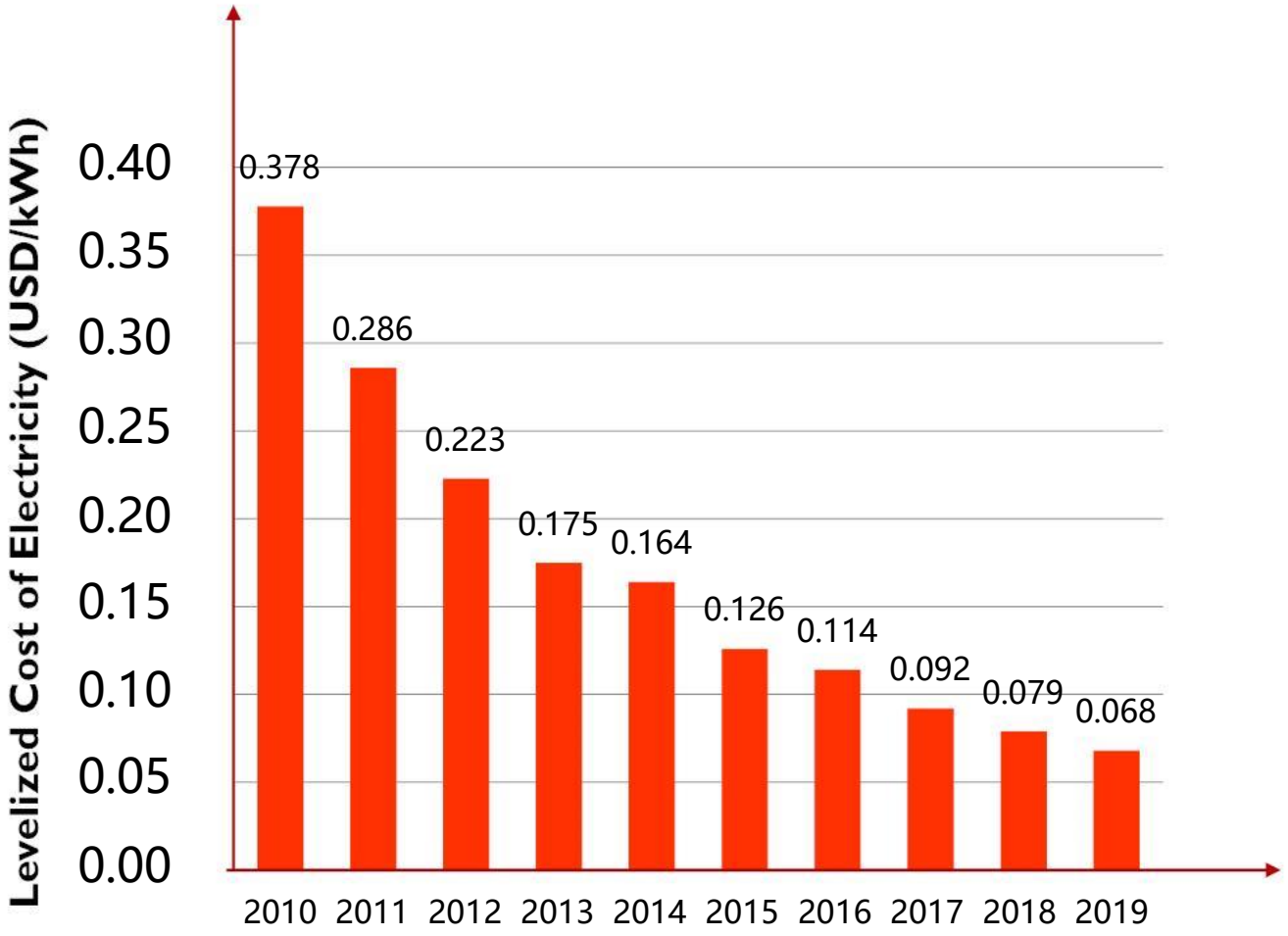


- Bloomberg’ s forecast, the global installed capacity will increase from 141GW to 170GW from 2020 to 2022, an annual increase of about 10%
- CPIA’ s forecast, from 2020 to 2030, the global installed capacity will increase from 130GW to 400GW, with an annual growth rate of about 15%
- So, in next ten years, the PV market will keep fast growing, all of us will have huge opportunity.

Photovoltaic LCoE continues to decline

According to the International Renewable Energy Agency (IRENA) forecast：

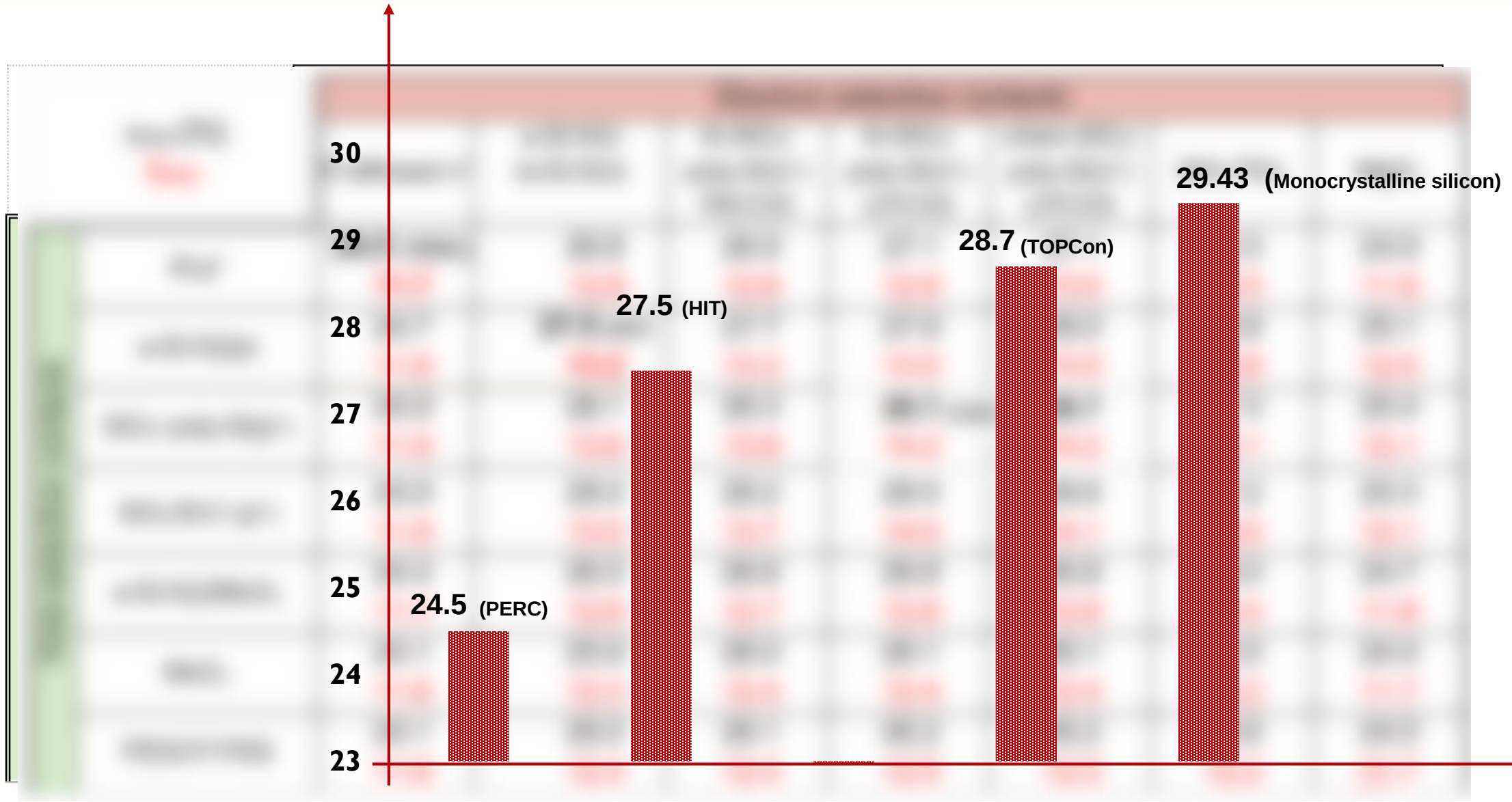
- The decline in PV LCoE is the largest among new energy sources
- From 2010 to 2019, LCoE dropped from USD 0.378/kWh to USD 0.068/kWh， **a drop of 82%. In the Middle East, PV power is only US$0.0135/kwh, a drop of 96%**



*Data from IRENA

Based on n-type technology!

Cell limit efficiency comparison



J. Schmidt, R. Peibst, and R. Brendel, Sol. En. Mat. Sol. Cells 187, 39 (2018).

JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO., LTD.

SUBSIDIARY OF JOLYWOOD GROUP

- Founded in 2016, **Jolywood Group (SZ300393)** holding subsidiary. Registered capital $355M, Total asset $672M, Net asset $388M
- Focuses on the production of N-type solar cells and modules. we have TOPCon soalr cell capacity 3.6GW. 3.0GW Jolywood module. now Jolywood is the Tier 1 brand of Bloomberg

3.6 GW

n-TOPCon
Bifacial Cell
Production Capacity

3.0 GW

n-TOPCon
Bifacial Module
Production Capacity

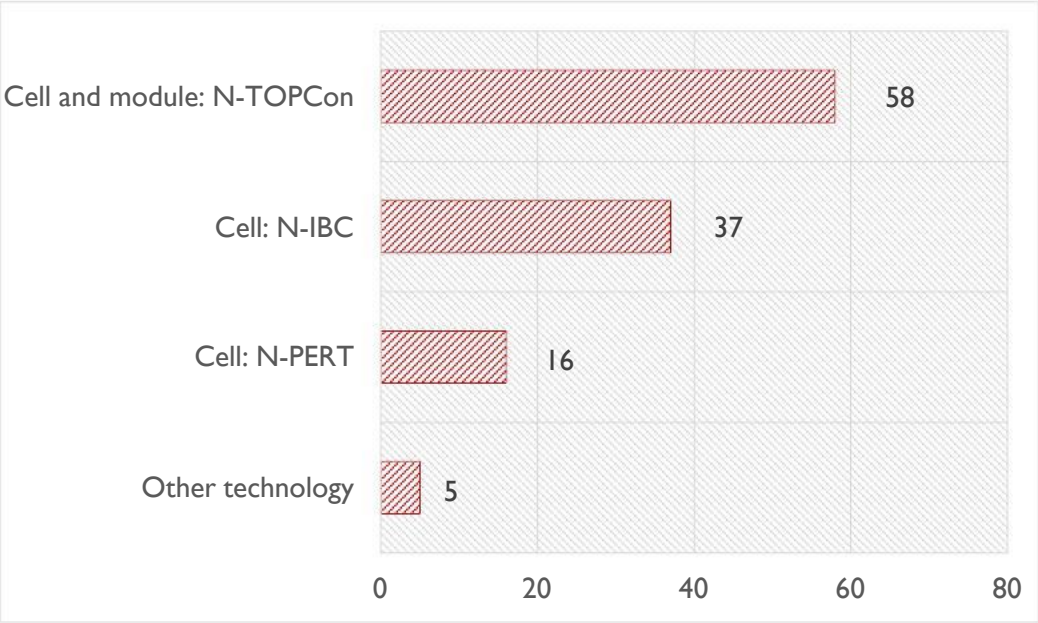
国家绿色工厂 Qualified China Green Factory by MIIT

全球新能源企业500强 Global Top 500 Energy Enterprise

高新技术企业 Qualified High-tech Enterprise

1 Bloomberg TIER NEW ENERGY FINANCE

N-type Bifacial Cell and Module Patents

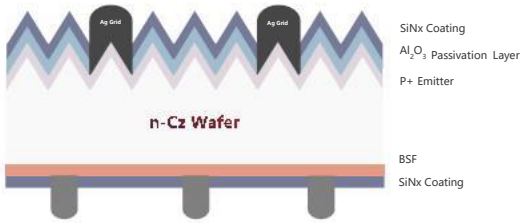


- Jolywood N-type patents covered cell and module technologies on n-IBC, n-TOPCon, n-PERT.
- 116 patents applied on N-type technology
- 67 patents granted and 21 of those granted patents on n-TOPCon technology

Jolywood N-type Technology

2016-2018

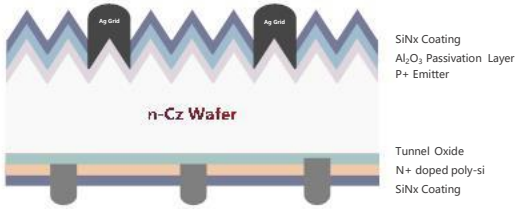
21.5%-22%
N-PERT cell



- Average production line efficiency 22%

2019-2025

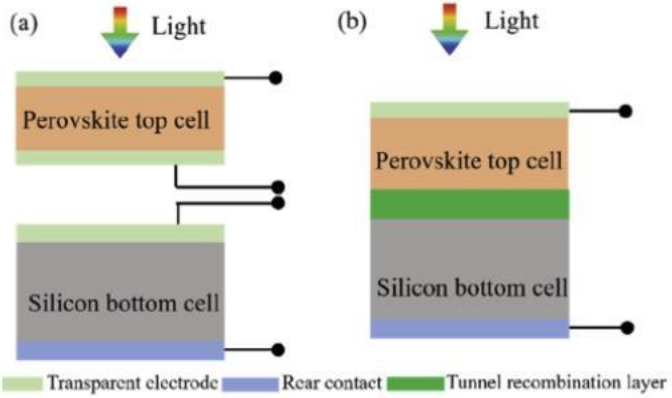
23.5%-25.5%
N-TOPCon cell in mass production



- Existing mass-produced capacity 3.6 GW
- V_{oc}>700mV
- Cell efficiency 24.5%

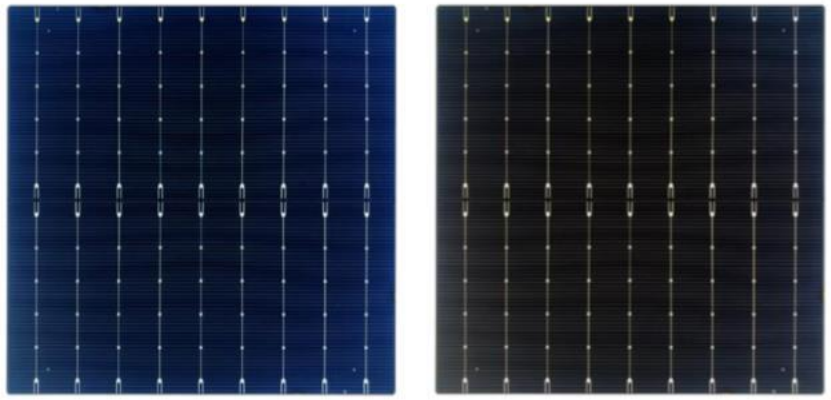
2023-2025

>26%
Tandem cell

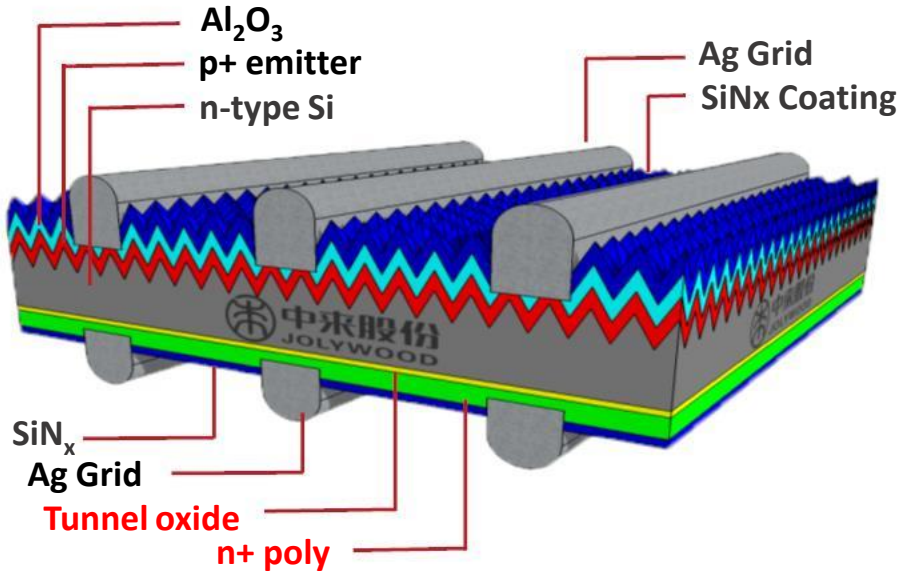


- Planning

TOPCon Unique Advantages



NTOPCon 9BB Bifacial cell



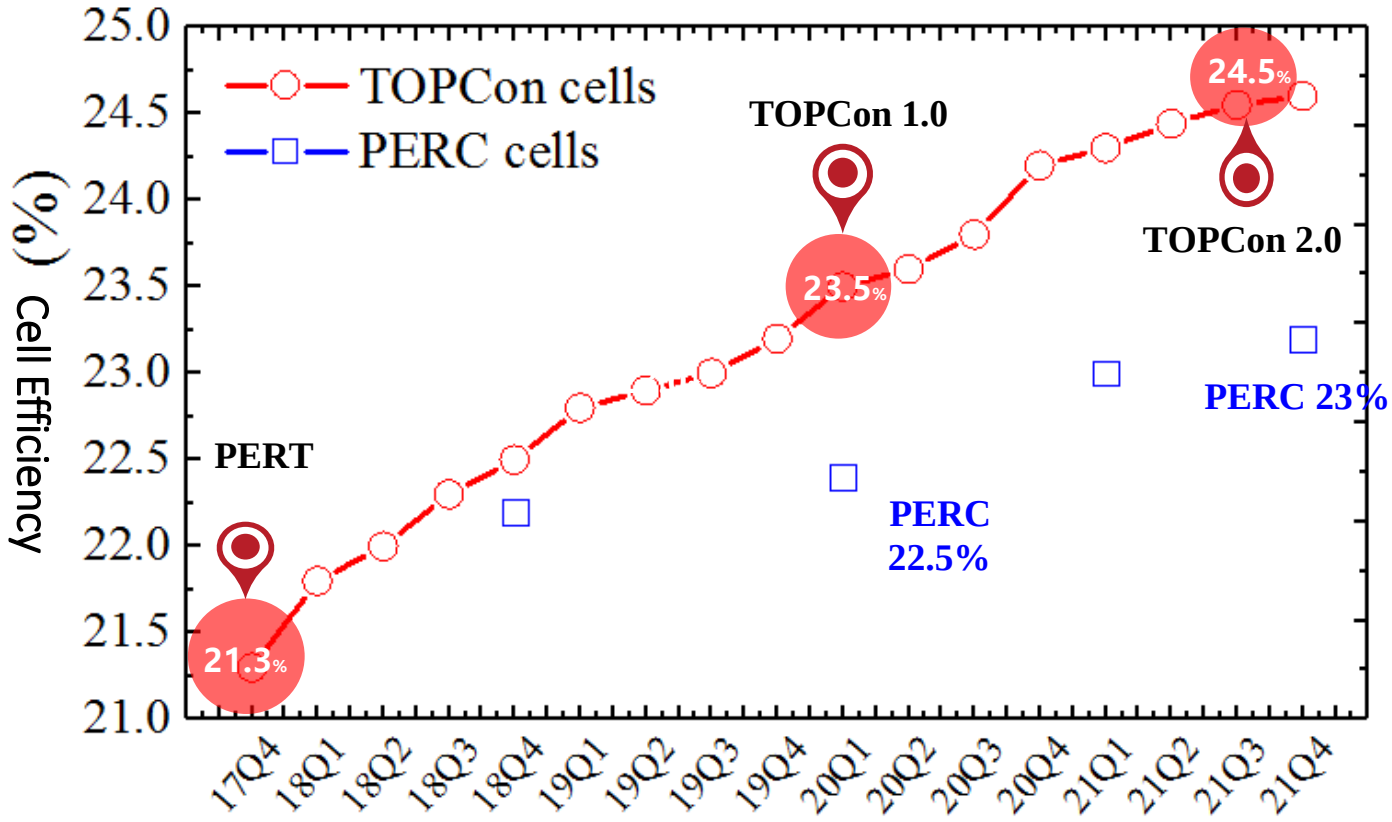
Advantages of n-TOPCon:

- n-type material → High lifetime and no LID
- Lower degradation, first year -1%, annual -0.4%
- Tunnel oxide passivation → Cell V_{oc}~700mV
- Low Temp coefficient~- 0.32%/ ℃
- Double side sliver fingers (30um)→ High bifaciality~ 85%

TOPCon and PERC cell efficiency development trend

- Two Cell Technology Advantages and Development Trends—Not just high efficiency

Parameters	PERC	TOPCon 2.0
Voc	685 mV	> 705 mV
Efficiency	22.8%	24.5%
Bifaciality	70%	85%
LID	~1.5%	0
LeTID	High risk	No risk
1st year degradation	~2%	<1%
Temperature coefficient	-0.36%/℃	



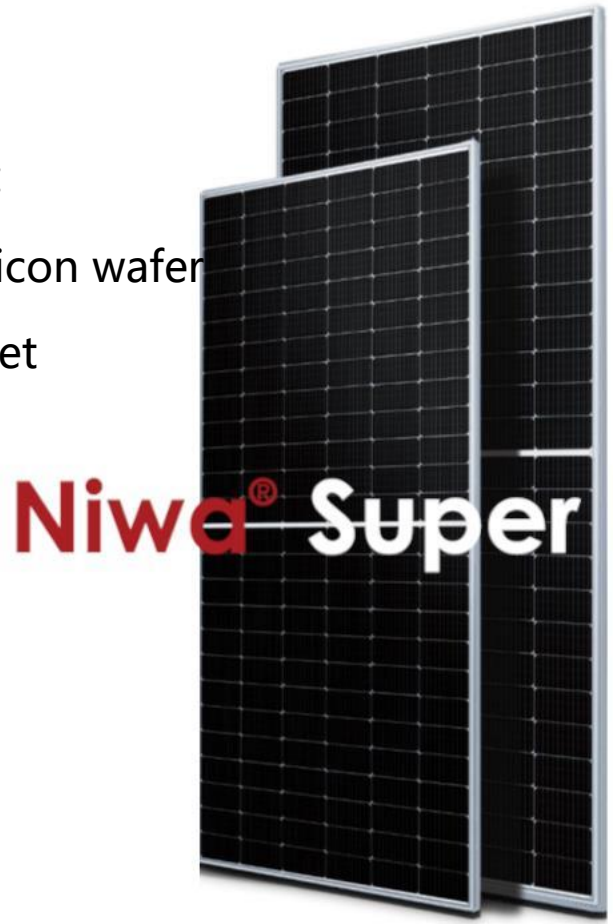
- **TOPCon has higher efficiency potential and stability.** PERC cell due to silicon wafer body area recombination and back metal contact technology limitations, resulting in its efficiency improvement gradually becoming saturated.

Jolywood N-TOPCon high efficiency bifacial large size modules

Niwa - We only make more efficient n-type bifacial

Technical advantages:

- N-type large size silicon wafer
- Black mesh backsheet
- TOPCon cells
- Multi-busbar
- Halfcut technology
- High reliability



Technical advantages:

- **570W/615W High power**
- 182mm large size silicon wafer
- World initial POPAID-TOPCon solar cell technology
- Halfcut technology
- 11BB multi-busbar
- High reliability
- Nano alloy backsheet

TOPCon value advantage - high ROE return

N type J-TOPCon 2.0 570W vs P type XX 540W

↓3.9%

BOS Cost

↓6.6%

LCOE Price

↑3.9%

ROE

- N-TOPCon 2.0 module: Power570W，bifaciality 80%, temperature coefficient -0.32%, 1st year degradation 1%, annual degradation 0.4%
- P type XX module: Power 540W, bifaciality 70%, temperature coefficient -0.37%， 1st year degradation 2.5%， annual degradation 0.5%

Application of Jolywood n-TOPConTechnology

‘Panda’ Power plant-29.21 MW

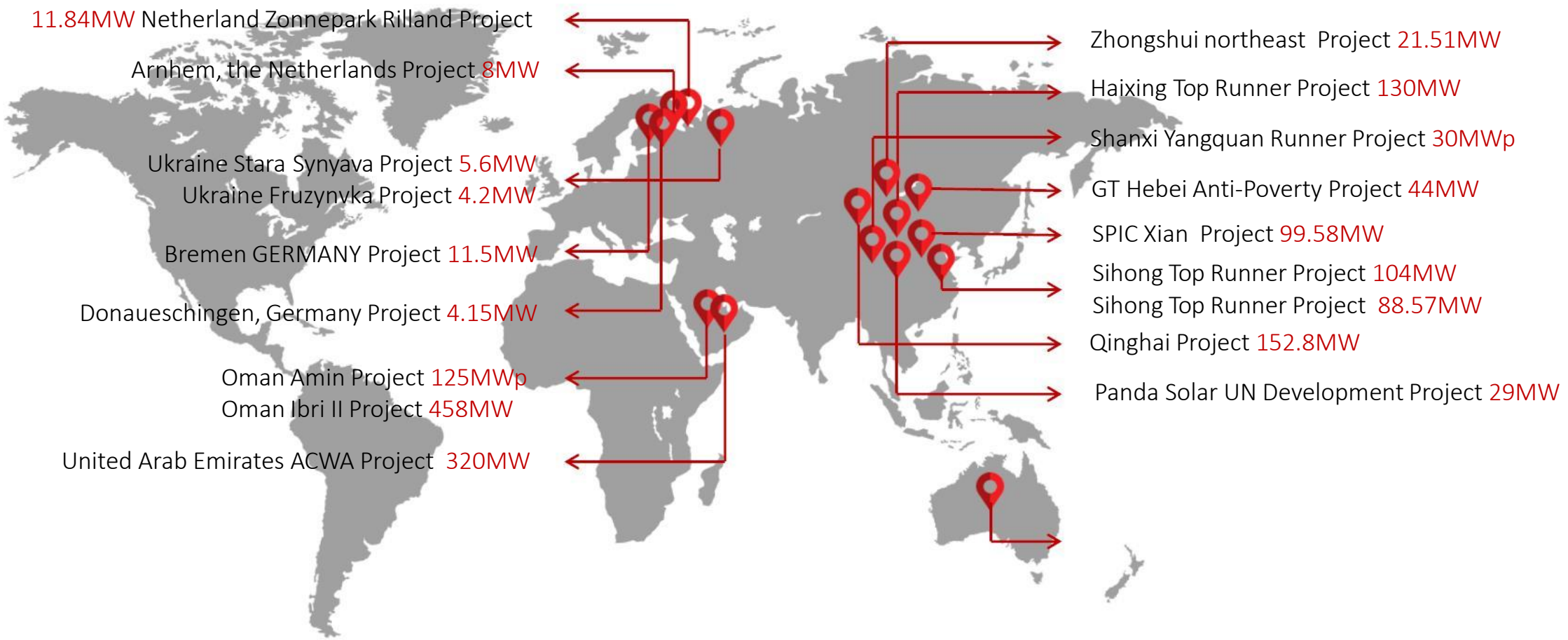
Sihong Fish-farming Project

Oman 125MW Solar Project

Netherland Zonnepark Rilland 11.75 MW

Ukraine Fruzynvka/Stara Synyava Projects

Global layout of Jolywood N-type bifacial modules



- Cumulative shipment of n-type bifacial modules to be above 4.1GW till end 2020

Opportunities to set factory in Indonesia

- Our partners Masdar, ACWA, EDF, etc. are all participating in the local government PPA project in Indonesia. The annual demand of ~500MW, and the products need to meet more than 40% TKDN of localization. The supply of these projects requires localized factory.
- Our partner informed that Indonesia's annual government demand projects of about ~500MW
- There is no tax on Indonesian PV modules exported to the United States. The installed capacity of 2021 in the U.S. market is predicted to be 22.2GW, and the module price is about ~30 cents /W. Export of products to the United States is a huge opportunity in the future.

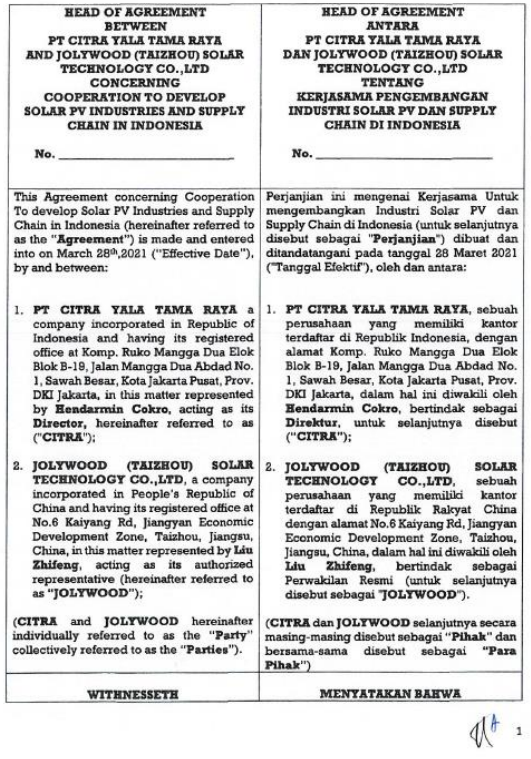
Jolywood Group investment intention in Indonesia

Based on the needs of Jolywood’s core customers, the needs of Indonesia's domestic market and U.S. market and the future of Jolywood’s global factory layout.

After investigation, it's a good opportunity for Jolywood to invest factory and module factory in Indonesia!

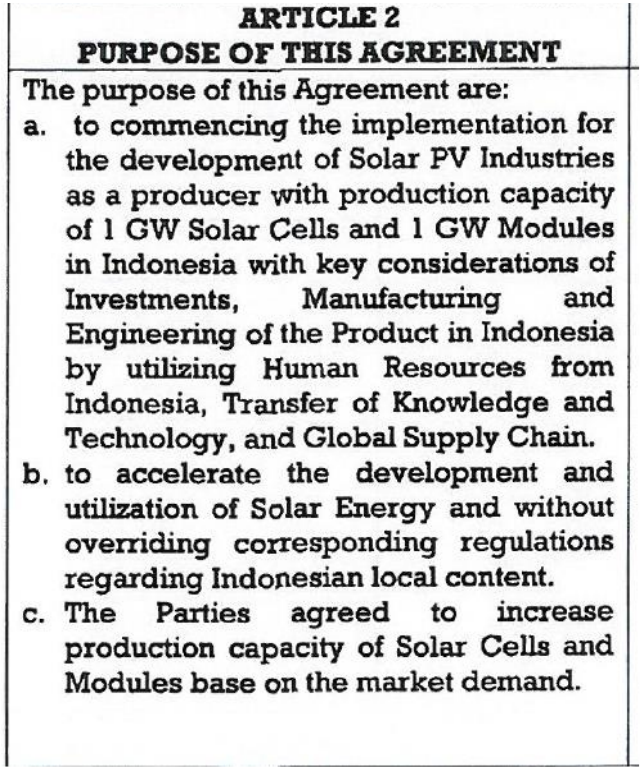
Jolywood Group investment budget

- **Total investment is ~91 million US dollars to build 1GW high-efficiency solar cells and 1GW large-scale high-efficiency solar modules factories, with Jolywood accounting for 60% and CITRA accounting for 40%. After completion, it will be the largest photovoltaic factory in Indonesia!**



HEAD OF AGREEMENT BETWEEN PT CITRA YALA TAMA RAYA AND JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO.,LTD CONCERNING COOPERATION TO DEVELOP SOLAR PV INDUSTRIES AND SUPPLY CHAIN IN INDONESIA No. _____	HEAD OF AGREEMENT ANTARA PT CITRA YALA TAMA RAYA DAN JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO.,LTD TENTANG KERJASAMA PENGEMBANGAN INDUSTRI SOLAR PV DAN SUPPLY CHAIN DI INDONESIA No. _____
This Agreement concerning Cooperation To develop Solar PV Industries and Supply Chain in Indonesia (hereinafter referred to as the "**Agreement**") is made and entered into on March 28th,2021 ("Effective Date"), by and between:	Perjanjian ini mengenai Kerjasama Untuk mengembangkan Industri Solar PV dan Supply Chain di Indonesia (untuk selanjutnya disebut sebagai "**Perjanjian**") dibuat dan ditandatangani pada tanggal 28 Maret 2021 ("Tanggal Efektif"), oleh dan antara:
1. **PT CITRA YALA TAMA RAYA** a company incorporated in Republic of Indonesia and having its registered office at Komp. Ruko Mangga Dua Elok Blok B-19, Jalan Mangga Dua Abdad No. 1, Sawah Besar, Kota Jakarta Pusat, Prov. DKI Jakarta, in this matter represented by **Hendarmin Cokro**, acting as its **Director**, hereinafter referred to as ("**CITRA**");	1. **PT CITRA YALA TAMA RAYA**, sebuah perusahaan yang memiliki kantor terdaftar di Republik Indonesia, dengan alamat Komp. Ruko Mangga Dua Elok Blok B-19, Jalan Mangga Dua Abdad No. 1, Sawah Besar, Kota Jakarta Pusat, Prov. DKI Jakarta, dalam hal ini diwakili oleh **Hendarmin Cokro**, bertindak sebagai **Direktur**, untuk selanjutnya disebut ("**CITRA**");
2. **JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO.,LTD**, a company incorporated in People's Republic of China and having its registered office at No.6 Kaiyang Rd, Jiangyan Economic Development Zone, Taizhou, Jiangsu, China, in this matter represented by **Liu Zhifeng**, acting as its authorized representative (hereinafter referred to as "**JOLYWOOD**");	2. **JOLYWOOD (TAIZHOU) SOLAR TECHNOLOGY CO.,LTD**, sebuah perusahaan yang memiliki kantor terdaftar di Republik Rakyat China dengan alamat No.6 Kaiyang Rd, Jiangyan Economic Development Zone, Taizhou, Jiangsu, China, dalam hal ini diwakili oleh **Liu Zhifeng**, bertindak sebagai Perwakilan Resmi (untuk selanjutnya disebut sebagai "**JOLYWOOD**").
(**CITRA** and **JOLYWOOD** hereinafter individually referred to as the "**Party**" collectively referred to as the "**Parties**").	(**CITRA** dan **JOLYWOOD** selanjutnya secara masing-masing disebut sebagai "**Pihak**" dan bersama-sama disebut sebagai "**Para Pihak**")
WITHNESSETH	**MENYATAKAN BAHWA**

1



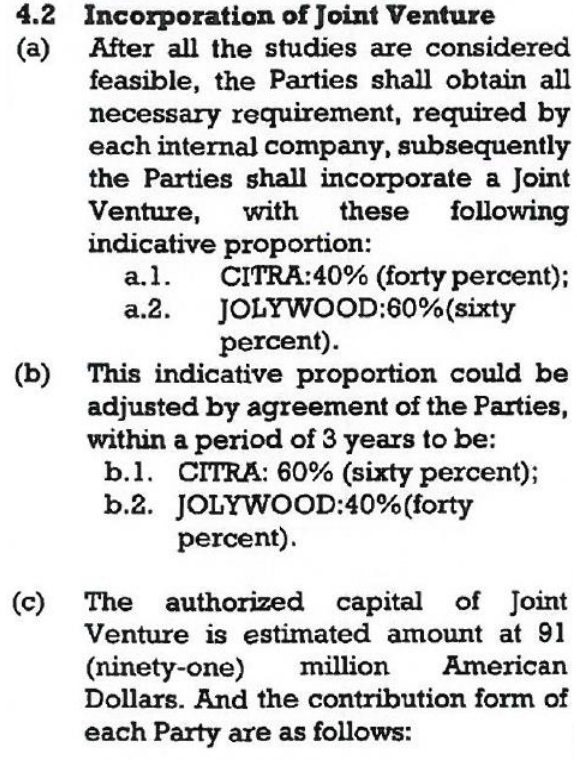
ARTICLE 2
PURPOSE OF THIS AGREEMENT

The purpose of this Agreement are:

a. to commencing the implementation for the development of Solar PV Industries as a producer with production capacity of 1 GW Solar Cells and 1 GW Modules in Indonesia with key considerations of Investments, Manufacturing and Engineering of the Product in Indonesia by utilizing Human Resources from Indonesia, Transfer of Knowledge and Technology, and Global Supply Chain.

b. to accelerate the development and utilization of Solar Energy and without overriding corresponding regulations regarding Indonesian local content.

c. The Parties agreed to increase production capacity of Solar Cells and Modules base on the market demand.

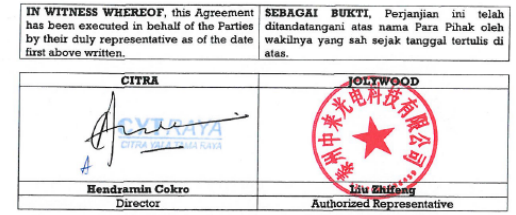


4.2 Incorporation of Joint Venture

(a) After all the studies are considered feasible, the Parties shall obtain all necessary requirement, required by each internal company, subsequently the Parties shall incorporate a Joint Venture, with these following indicative proportion:
  a.1. CITRA:40% (forty percent);
  a.2. JOLYWOOD:60%(sixty percent).

(b) This indicative proportion could be adjusted by agreement of the Parties, within a period of 3 years to be:
  b.1. CITRA: 60% (sixty percent);
  b.2. JOLYWOOD:40%(forty percent).

(c) The authorized capital of Joint Venture is estimated amount at 91 (ninety-one) million American Dollars. And the contribution form of each Party are as follows:



IN WITNESS WHEREOF, this Agreement has been executed in behalf of the Parties by their duly representative as of the date first above written.	SEBAGAI BUKTI, Perjanjian ini telah ditandatangani atas nama Para Pihak oleh wakilnya yang sah sejak tanggal tertulis di atas.
CITRA	JOLYWOOD
Hendramin Cokro	Liu Zhifeng
Director	Authorized Representative

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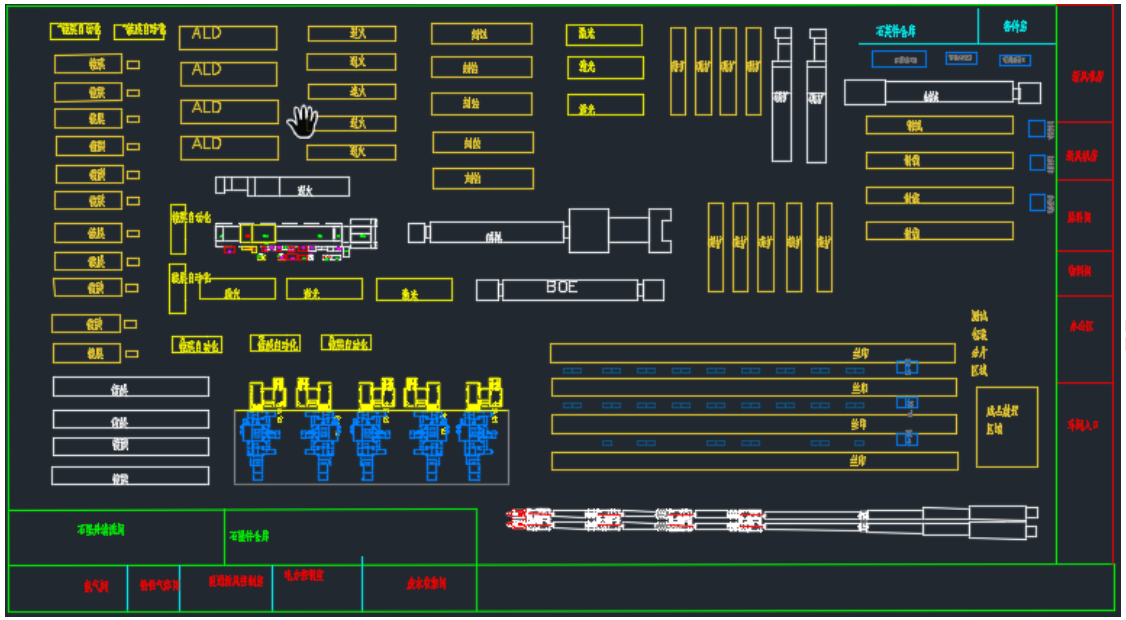
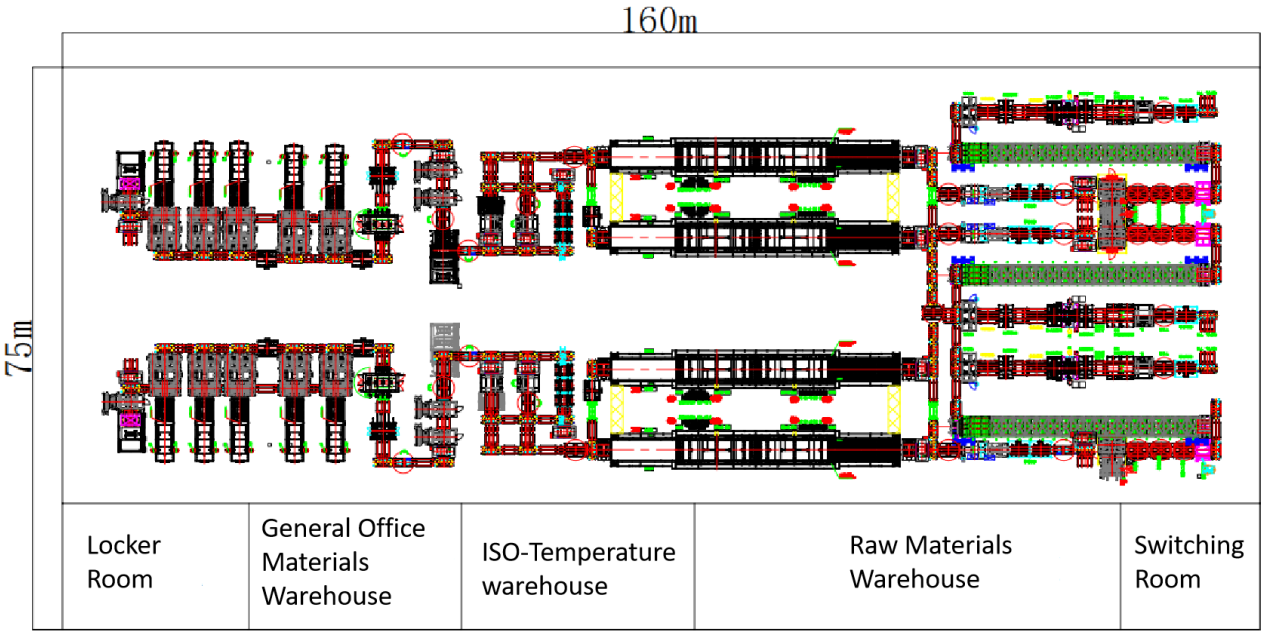
Cooperation mode

- **Co construction of 1GW module factory and 1GW cell factory**
  - Module factory and cell factory are planned to be implemented step by step



1GW cell factory



1GW module factory

Outlook and Conclusion

- Jolywood focuses on the production of N-type solar cells and modules and now has 3.6GW n-TOPCon cell and 3GW module capacity
- Progress in n-TOPCon bifacial solar cells in Jolywood:
  - Average efficiency of 23.85% achieved in production using ion-implantation and screen-printing
  - Average efficiency of 24.09% achieved in pilot line and 24.5% champion efficiency
- Jolywood bifacial modules have been widely applied in large amount of PV systems in the world with the lowest LCOE
- Jolywood Group decided to invest ~91 million US dollars to build 1GW high-efficiency solar cells and 1GW large-scale high-efficiency solar modules factories. Hope to get the local government support!

THANK YOU

www.jolywood.cn

Leader of n-type bifacial technology