Country Report:

LONGi (China)

Presented by: Xie Tian

Longi Green Techology Holding Ltd

Task1 Meeting，Adelaide，2023-10

Supported by: Mei Heng, Liu Chang, Wu Dongdan, Wang Yanfei

1. How PV Changed China

PV+ Creates Unlimited Potential of Ecological Development

PV Boosts Ecological Restoration

- PV technology is applied to various vulnerable ecological environments such as deserts and mudflats, explores "PV + ecological restoration" mode, contributes to the protection of the planet we live on by taking practical actions.

PV Turning Yellow to Green
Combats Desertification

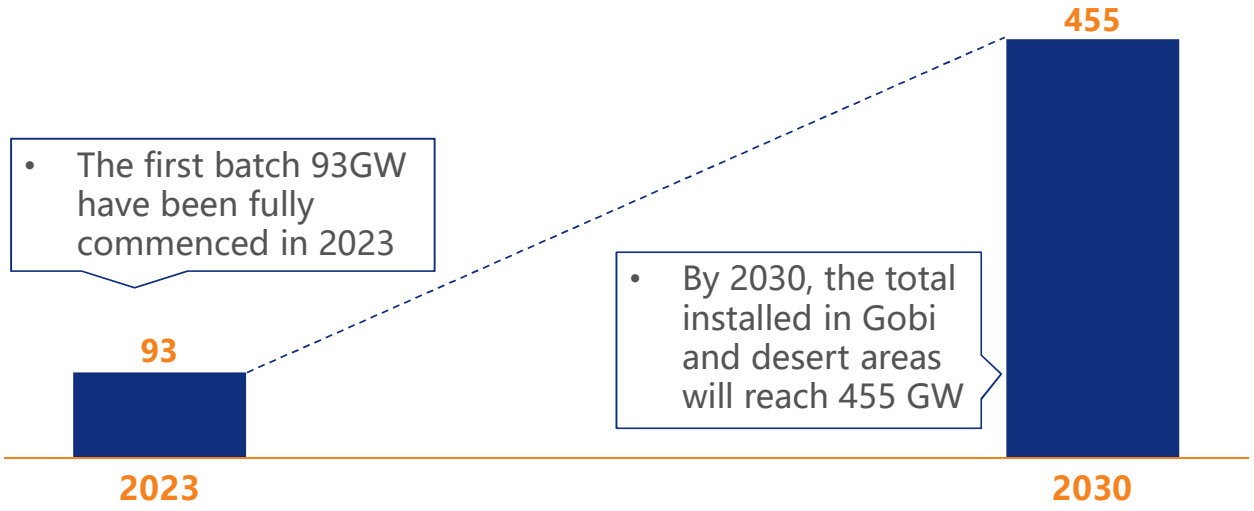
PV Turning Black to Green
Ecological Restoration of coal mine

PV Turning Yellow to Green

PV Combats Desertification

- China has long been striving to achieve **the goal of zero growth in land degradation by 2030** as proposed by the United Nations Convention to Combat Desertification (UNCCD)
- **On Oct. 2021**, it was officially proposed at the national level to accelerate the planning and construction of **large-scale wind power and photovoltaic (PV) base projects in deserts, the Gobi, and desert areas.**

PV installation in Gobi and Desert areas (GW)



Source: CN Energy News, Longi

> China is one of the countries with the most serious desertification, with a sandy land area covering for **~1/6 of country area**.

> Once completed, the PV panels reduce average north-south wind speeds by 50% and soil moisture evaporation by 30%

PVPS

PV Turning Black to Green

Accelerating the Transformation of a "Coal City"

- Under the background of "double carbon" target, the traditional coal mine "black to green" has become the development trend.
- Since the **"14th Five-Year Plan" ,** Chinese government has issued a number of documents to encourage the use of coal mining subsidence areas, open-pit mine dumps, mine closures and other coal mines to build wind/PV power plant
- Currently, it is expected to have a total capacity of **as much as 600GW** if all of coal mines are used to develop photovoltaic power plants
  - Coal mines are distributed in **23 provinces and 151 cities**
  - Area of coal mining area reaches **more than 2 million hectares**
- **Local bushes and other shrubs** are planted between the PV arrays to **restore and protect the surface ecology** of the coal mining subsidence areas, **achieving the simultaneous development of economic and ecological benefits.**

> Based on recent coal mine management experience in China, the effect of ecological restoration of installing solar panels is remarkable.
> - Reduce evaporated water on the surface by 20% ~ 30%,
> - Reduce wind speed, improve plant living condition

> Anhui province actively developed coal mining area for PV and other RE sources
> - **14 projects** built, **1.04 GW** in total
> - **6 pjts** constructing, **28 pjts** planning
> - **8.3 GW** PV installation planning
> - **13k hectares** of damaged land coverage

Source: CN Energy News, Longi, Anhui Province Development and Reform Commission

PV Products Serve As The Carriers and Amplifiers of Clean Energy

Solar energy serves as the energy source for silicon, while the latter functions as the primary carrier of the former.

Each watt of module consumes **0.4** kWh of electricity

With the efficiency of PV products increasing

+

With the proportion of green electricity usage growing

=

The electricity it generates is **greater over** the entire **100** times lifecycle

PVPS

According to calculations, from silicon mining to products (including industrial silicon, polysilicon, silicon wafers, PV cells, modules and necessary auxiliary materials), the energy consumption of the whole process is approximately **0.4 kWh per watt.** With a lifespan of more than 30 years and an average annual electricity output of over 1.5 kWh per watt, a SILICON-BASED PV system’ s energy output is more than **100 times greater** than its consumption.

Case Study 1: PV Turning Yellow to Green - Kubuqi

Overview of PV reinforcement of anti-desertification in Kubuqi

- The Kubuqi Desert was once one of the most desertified areas in China.
- Longi not only provides panels to national solar/wind plant, but also constructed solar plant in desert area to accelerate anti-desertification
- Currently, more than 2GW solar panel capacity is operating in Kubuqi Area, and a national Wind/solar power base is also under construction
- In total, Kubuqi national base project planning investment of more than 80 billion CNY, the total installed capacity of 16 GW, including
  - Renewable energy: Solar 8 GW, Wind 4 GW
  - Supporting powered power plant 4GW (advanced high-efficiency)

Participants in the development of solar power plants in Kubuqi*

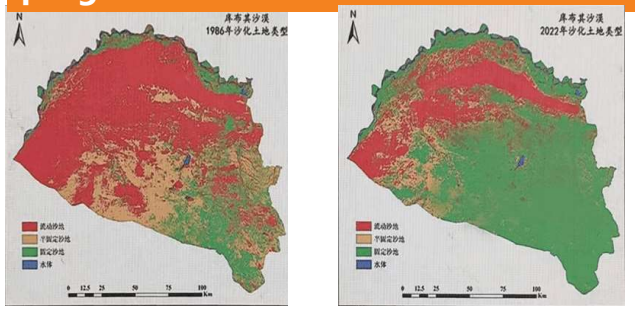
LONGi 隆基 · risen 东方日升 · Trinasolar 天合光能 · 通威股份 · JA Solar 晶澳光伏 · JinKO Solar · 中国国电 CHINA GUODIAN · 三峡能源 · 蒙能集团 IMEIGC · CHNT 正泰电器 · ELION 亿利洁能 · 中国华能 CHINA HUANENG · 中广核 CGN

*: Participants list is not comprehensive

Source: Government announcement, Longi, Desk research

Longi's Kubuqi PV project

Kubuqi Anti-desertification progress



1986 2022

Case Study 2: PV Turning Black to Green - Datong

Accelerating the Transformation of a "Coal City"

- Xinrong, Datong is located in the northern part of Shanxi province, the overdevelopment of the coal mining industry has worsened the local living environment.
- The period between 2018 to 2022 witnessed two phases of successful grid connected PV power generation of the Xinrong project.
  - Project abided by the requirements in the national *Ecological Protection Management* during construction and operation
- LONGi established PV power plant project adopting the mode of "PV + comprehensive management of coal mining ", with efforts:
  - Constructed 600MW power plant with 30MW energy storage
  - Promoted the virtuous circle development of the ecology
- After the construction, we planted local shrubs or shrub economic forests between the PV arrays to restore and protect the surface ecology of the coal mining subsidence areas, achieving the simultaneous development of economic and ecological benefits.

600 MW solar power plant in Coal mine area

30 MW energy storage affiliated

Source: Longi

2. How LONGi Changed PV

- 2.1 Efforts on Technology Advancement
- 2.2 Efforts on ESG

- **2.1 Efforts on Technology Advancement**

- 2.2 Efforts on ESG

- 2.1 Efforts on Technology Advancement

Commercialization
Scale of Economy

The perpetual focus in technological innovation is to reduce costs, increase efficiency

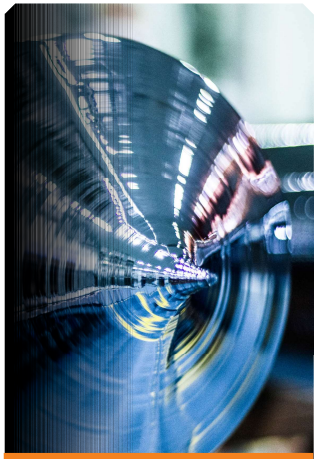
Invest in Innovation
Technological Breakthrough

The driving force behind the reduction in photovoltaic power costs

2.1 Booming of PV is Unachievable w/o Key Technology Promotion

Insist on adopting the First Principle thinking

Each and every major technological innovation has set new trends in the photovoltaic industry, pushing the industry forward.

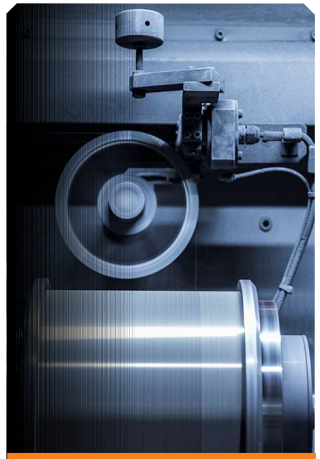


Mono-Crystalline
Technology Path

- Even if mono-crystalline silicon ingots cost nothing, monocrystalline will remain competitive.
- LONGi will continue to refine and expand its mono-crystalline silicon path.

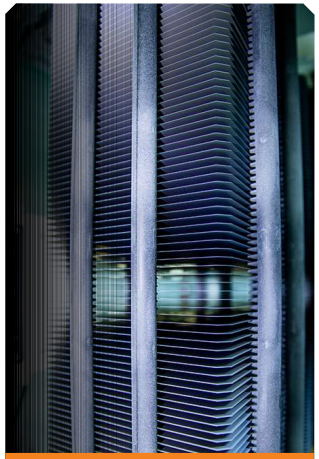
RCz
Technology

- 80+% increase in silicon ingots pulling speed.
- Reduced downtime, disassembly and furnace installation time.
- **Reduces quartz crucible and high-purity quartz sand consumption.**



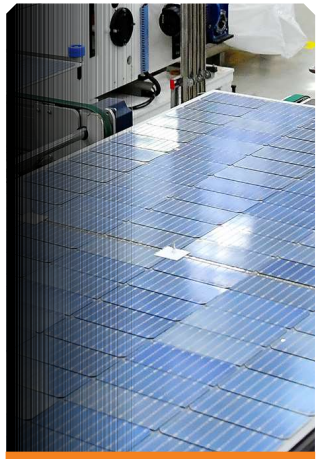
Diamond Wire Wafer-Slicing
Technology

- 30% reduction of silicon raw materials used annually in photovoltaic industry.



PERC
Technology

- Pushed Mono-crystalline silicon PERC industry innovation to its current mainstream status.
- Offered LIR technology to the world.
- Accelerated the reduction in cost for photovoltaic systems.



Bifacial
Technology

- Bifacial modules have become the standard in centralized power plants.
- 8-15% power generation gains.
- Powerful driving force behind the reduction of costs per kilowatt-hour.

2.1 Applicable Innovation Accelerates Industry Evolution

All technological innovation is quickly applied to large-scale, advanced production, while promoting client-end applications stimulating the reduction of power cost per kilowatt hour.

Mono-Crystalline Silicon Technology Advancement
RCz Technology
Diamond Wire Wafer-Slicing Technology
Wafer Quality Improvements

PERC Technology
Hi-MO 1
Low Degradation
High Efficiency Module Era

PERC Bifacial
Hi-MO 2
Bifacial modules
Significant increase in power generation

Half-Cell Technology
Hi-MO 3
Mass production
Increased power and reliability

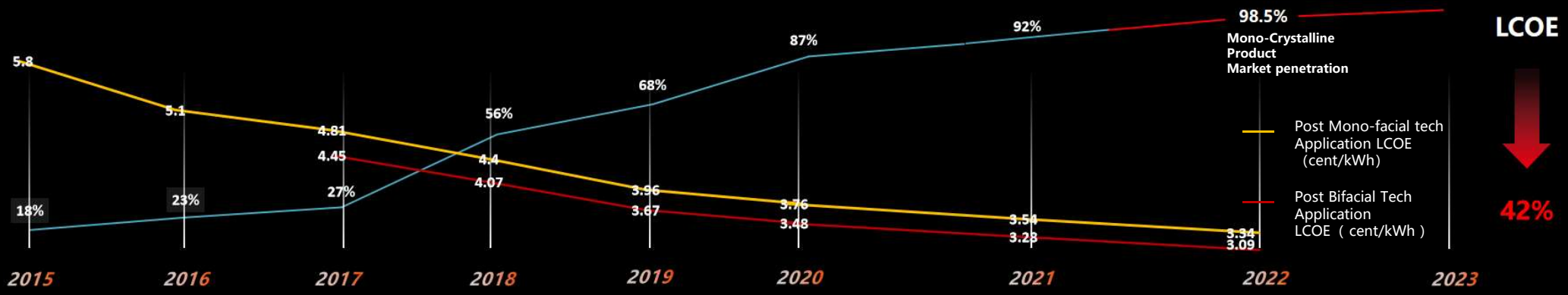
M6 standard
Hi-MO 4
Global bestseller
Full-scenario M2 module
Replacement

Perfectly Sized
Hi-MO 5
For large power plants
Smart welding for improved module efficiency

LONGi Lifecycle Quality
Industry first in product life cycle quality standard

HPBC New Tech Cell
Hi-MO 6
For globally distributed users
First "customized" module

HPDC New Tech Cell
Hi-MO 7
Designed for the utility market
Innovative Bifacial dual junction cell technology

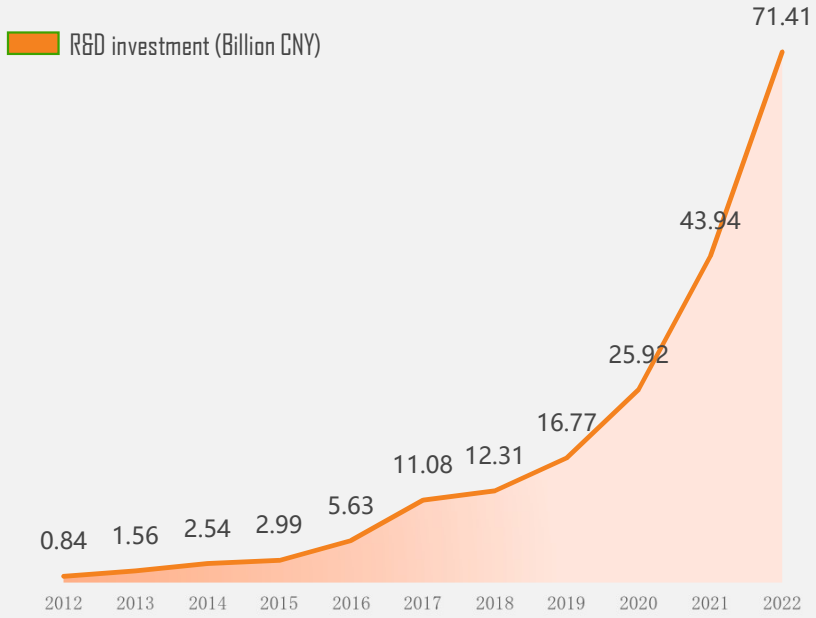


2.1 Investments Paved the Way for LONGi Innovative Achievements

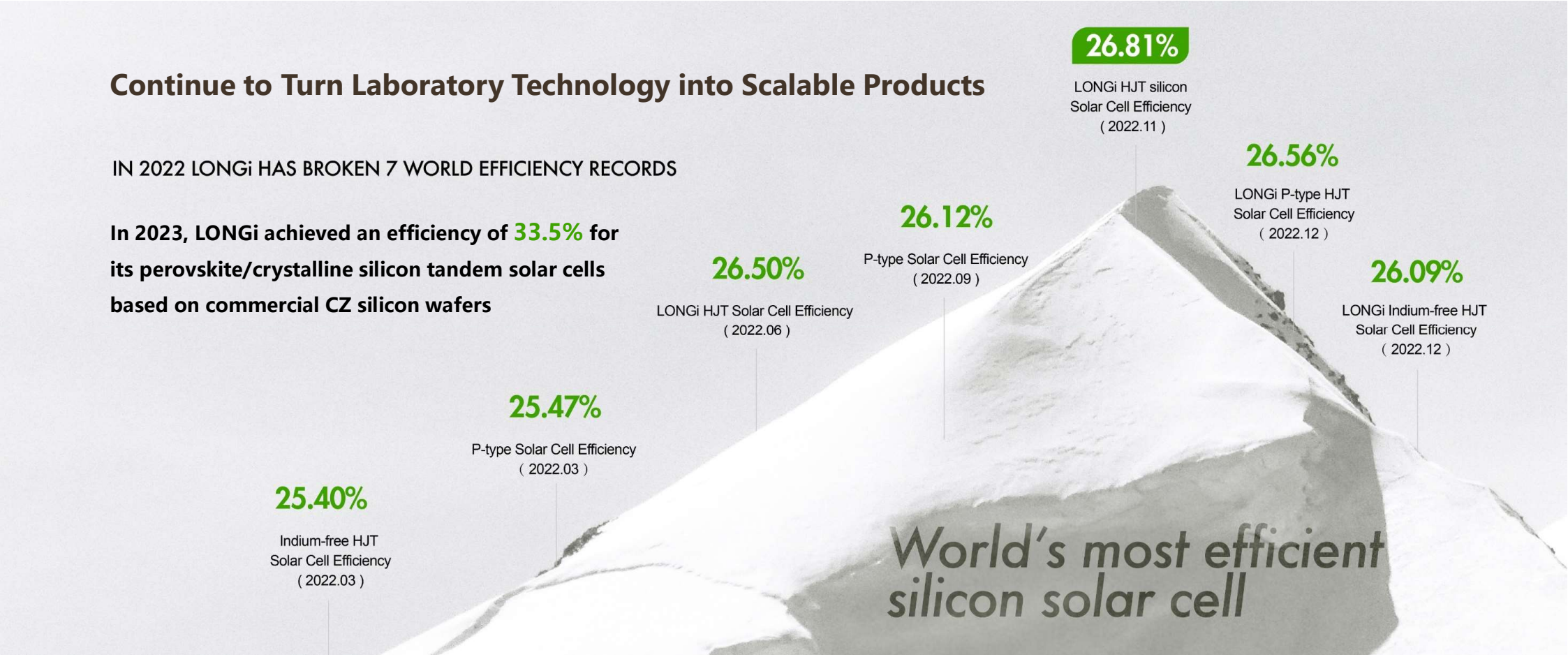
2132
Registered Patents

nearly *2.8 Billion USD*
20 Billion CNY
R&D investments

LONGi Central R&D Institute
Building a "PV Intellectual Center"



2.1 Never Stop to Push Beyond the Frontier



- 2.1 Efforts on Technology Advancement

- **2.2 Efforts on ESG**

2.2 Efforts on ESG: Actively Responds to the Global Climate Changes

LONGi has been approved by SBTi for its emission reduction targets.

LONGi had initiated carbon reductions with green supply chain in the solar industry to facilitate low carbon economic development and realizations of climate goals.

LONGi joined the initiatives of RE100, EV100, and EP100 from the Climate Group, and fulfills its commitments for the entire society.

SBTi SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

SBTi targets: by 2030, the GHG (greenhouse gas) emissions within the operational boundary is scheduled to reduce by 60% from that of the 2020 level; the carbon emissions of unit silicon material, cell and glass will be reduced by at least 20% compared with that in 2020.

RE100

RE100: LONGi promises to achieve the use of 100% renewable energy for the electricity required for global production and operation by 2028.

EV100

EV100： LONGi promises to install adequate power charging facilities for electric vehicles in all production and operation bases to encourage and support green travel..

EP100

EP100: LONGi promises to complete its energy management system deployment by 2025 and raise its energy utilization efficiency by 35%, starting from 2015.

PVPS

2.2 Building a Green Value Chain

- We will continue to improve the industry’ s green supply chain system and adopt a more accurate value chain emissions accounting methodology to provide empowerment support to our suppliers.
- We are committed to avoiding the procurement and use of controversial materials. A vertically integrated and relevant product traceability management system has been established.

150+

Carbon reduction initiatives

LONGi launches carbon reduction initiative with 150+ suppliers

27

Supplier Self-Assessment

Facilitated 27 suppliers to undertake green supplier self-assessment

30

IPE platform monitoring

Monitoring of environmental information from 30 suppliers using IPE's supply chain management platform.

400+

Green Partner Empowerment

In 2022, LONGi, in conjunction with Towngas Energy, completed the first phase of Carbon Empowerment training for at least 400 suppliers.

At the 2022 LONGi Green Energy Supplier Conference, LONGi officially released the "Supply Chain Green Partner Empowerment Program", which plans to promote energy saving and emission reduction actions of supplier partners through carbon management empowerment training, promoting the reduction of carbon footprint of LONGi PV products.

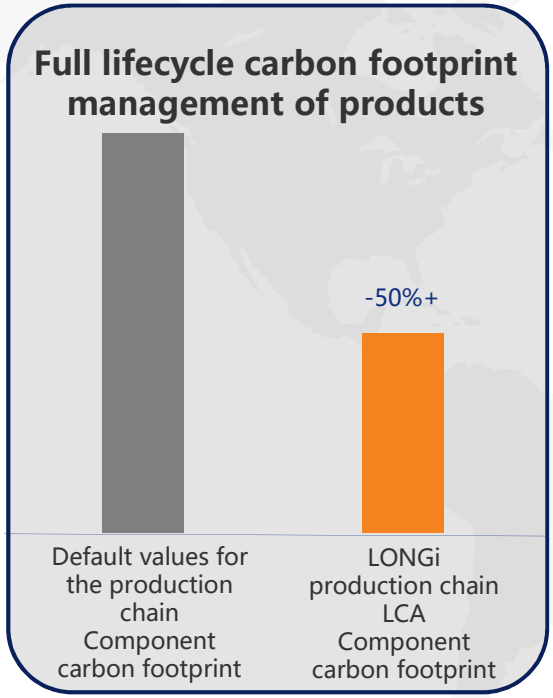
Selected external approvals for materials used in components

TUV CQC CGC CTC

2.2 Participate in Global Carbon Footprint Certification for PV

Carbon Footprint Certification / Plant LCA Layout

Optimise module carbon footprint scores through LCA work layouts to meet market & customer product carbon footprint requirements and gradually improve the low carbon market competitiveness of LONGi modules.



France's carbon footprint

France's carbon footprint certificate covering all products

PV Cycle

Certified for green component recycling

EPD Low Carbon Products Statement General ISO14067

Certification in progress

ISO14064

Scope 1+2+3 Enterprise Carbon Inventory completed

LCA layout of domestic production sites

Over 8 production sites accounting for carbon emissions

Korea's Carbon Footprint

Level 1 certification in progress

KOREA ENERGY AGENCY

>7

Carbon footprint related certification layout (2019-2022)

>8

Own plant LCA layout (2019-2022)

>10

Carbon emissions GWP from pulling crystal to module production

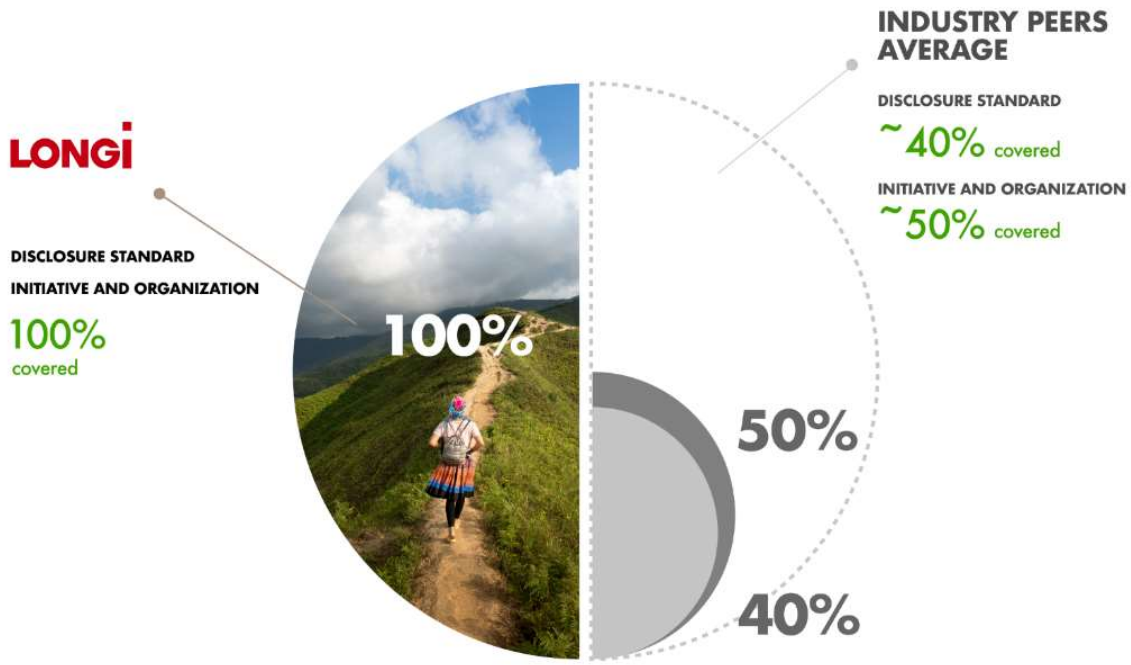
2.2 Initiated the World's First "Net Zero Solar" Concept

Only Chinese PV industry

LONGi has been approved by SBTi for its emission reduction targets

Aligning with the 1.5℃ target
in the Paris Agreement

2.2 To Lead in Engagement of Initiatives and Practice



DISCLOSURE STANDARD

SUSTAINABLE DEVELOPMENT GOALS · PRINCIPLE · GRI · TCFD · SASB CONSULTANT CONTENT PROGRAM · CDP

INITIATIVE AND ORGANIZATION

United Nations Global Compact · SCIENCE BASED TARGETS · UNEP

RE100 EV100 EP100

2.2 Fully Responses to UN-SDGS and is Widely Acclaimed

LONGi pushes forward the integration of the UN 2030 Sustainable Development Goals (SDGs) with the business value chain, identifies the importance and significance of the relevant SDGs for the Company, and strives to include sustainability concepts and actions into corporate strategy and operations.

2022 Bloomberg
Green ESG Pioneers Enterprises

Fortune 2022
China ESG Impact List

Forbes 2022
ESG 50

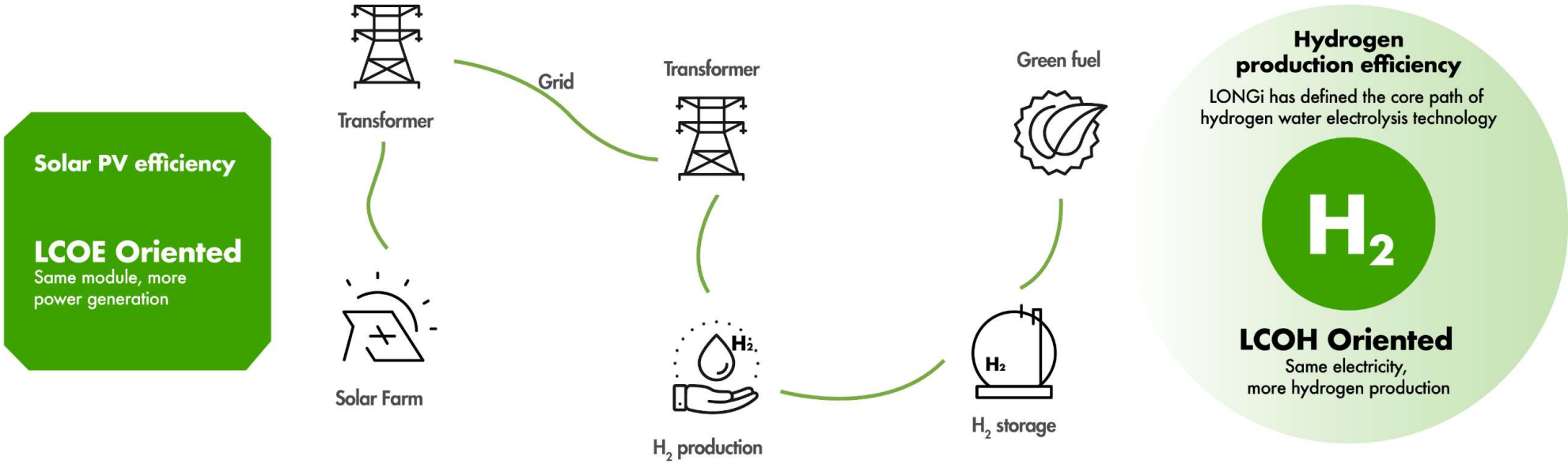
2022 Corporate Knights
Corporate Sir 100 Best Sustainable Companies in the world

PVPS

3. How LONGi See PV Will Continue to Change the World

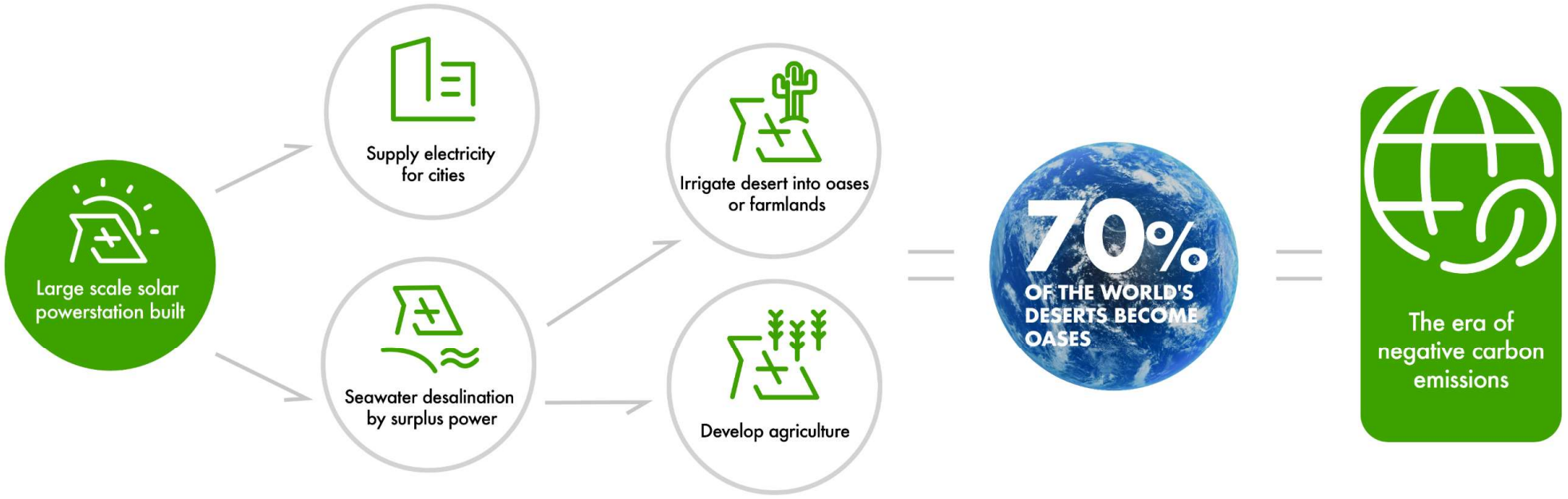
3. We Firmly Believe “Green Power + Green Hydrogen”

WE FIRMLY BELIEVE THIS WILL BE THE ULTIMATE SOLUTION TO ACHIEVE CARBON NEUTRALITY



3. To Create a New Era of Negative Emission

LONGi WILL JOIN HANDS WITH THE GLOBE, FURTHER LEVERAGING SOLAR ENERGY



iea-pvs.org

Thank you!

Xie Tian，IEA PVPS TASK1

Xiet@longi.com

Case Study 1: 光伏治沙-库布其

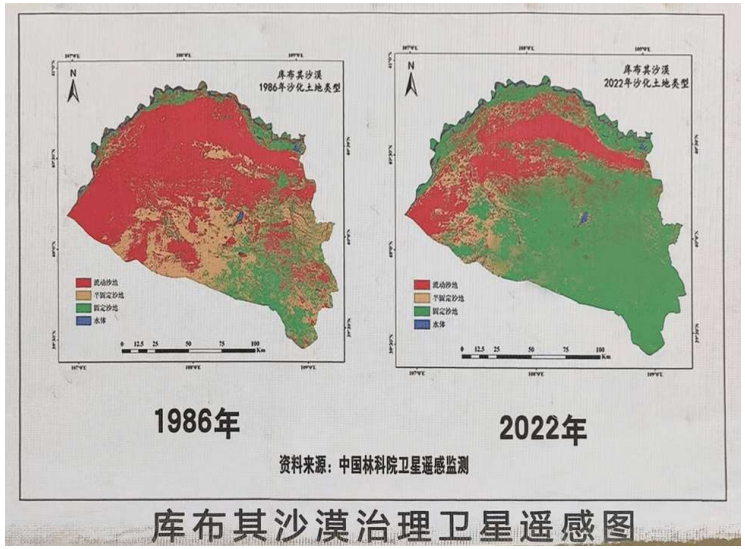
库布齐沙漠曾是中国荒漠化最严重的地区之一，在光伏的有效覆盖下，不仅可以带来可观的发电收益，还能够有效遮挡地面日照和降低水分蒸发，促进植被的生长和恢复，有助于种植业、养殖业的开展。

库布其基地项目规划总投资超800亿元，总装机规模1600万千瓦，包括光伏800万千瓦和风电400万千瓦，配套改扩建先进高效煤电装机400万千瓦。 此次宣布开工的先导工程为100万千瓦光伏发电项目，并配置建设相应储能设施。

“如果将全球荒漠面积的1%用以光伏发电，就可以满足人类的用电需求，而当地球荒漠面积的70%变为绿洲时，更可以吸收人类活动以来造成的所有碳排放”，李振国认为，那时所有因碳排放产生的社会、环境问题都会迎刃而解，而这也正是隆基“Solar for Solar-负碳地球”理念所希望实现的最终目标。

其他参与方

亿利集团，中广核，中国长江三峡集团有限公司所属公司，**国电电力，华能集团，蒙能集团**
晶澳，正泰，**通威，东方日升，天合，隆基**



库布其沙漠治理卫星遥感图

Case Study 2:

"Turning Black to Green", Accelerating the Transformation of a "Coal City"

In Xinrong district, Datong in the northern part of Shanxi province, the overdevelopment of the coal mining industry has worsened the local living environment. LONGi established "LONGi's PV power station project in Xinrong, Datong, Shanxi " in coal mining subsidence areas in Datong. This project adopts the mode of "PV + comprehensive management of coal mining subsidence areas" based on local conditions, realises resource reuse, and promotes the virtuous circle development of the ecology in the coal mining areas. The period between 2018 to 2022 witnessed two phases of successful grid connected PV power generation of the Xinrong project. LONGi strictly abided by the requirements in the *Ecological Protection Management Measures of National Advanced Technology Photovoltaic Demonstration Base on Coal Mining Subsidence Areas of Datong* during construction and operation. After the construction, we planted local shrubs or shrub economic forests between the PV arrays to restore and protect the surface ecology of the coal mining subsidence areas, achieving the simultaneous development of economic and ecological benefits.

"PV Reached Remote Mountain Area", Spreading Low-Carbon Hopes

Located in the transition zone between the Qinghai-Tibet Plateau and the Loess Plateau, the rugged Yongjing county is troubled by inconvenient transportation, which hinders its economic development. LONGi established the first batch of photovoltaic power projects of the "Fourteenth Five-Year Plan" in Yonjing County. Adopting the mode of "PV + ecological governance + forest and grass planting", we planted suitable sand plants with high economic value in the PV areas, achieving the goals of improving ecology and protecting the environment while increasing economic returns. This project provides around 212 million kWh of green electricity to Yongjing County annually, saving around 69,600 tonnes of standard coal. It effectively alleviates the electricity shortages in the Hedong region of Gansu, promotes local economic growth, and provides a constant source of green power to achieve the "dual carbon" goals as scheduled.

PV Power Project in Yongjing County, Gansu

Practicing Corporate Climate Action

Sustainability Report

- LONGi has published its *Sustainable Development Report* for **six**
- LONGi has openly disclosed various measures addressing climate change and its related initiatives in corporate social responsibility (CSR).

Climate Action White Paper

- **Two** Climate Action White Paper (2021-2022)
- LONGi released the second Climate Action White Paper at the 27th United Nations Climate Change Conference (COP27).

"LONGi has established an internal greenhouse gas emissions accounting system covering the company's entire value chain (Scope 1, 2, and 3)."

--- 2022 LONGi White Paper

责任投资：机构投资者日趋关注企业的ESG风险与表现，企业应积极提升公司非 财务信息质量和透明度

资金方：在全球范围内，越来越多的投资者已开始将环境、社会和治理（ESG）因素纳入投资决策过程中，以更好地管理风险，并产生可持续的长期回报。

75%

75%的投资者认为他们的公司已经改 变了投票和/或参与政策，以更加关 注ESG风险

2/3

2/3的机构投资者相信ESG将在未来5年内成为“行业标准”

40bp

40bp的平均资本收益差别存在于MSCI全球指数头部企业与尾部企业之间

20%

贝莱德预测20%的ETF基金至2028 年将会与ESG评级挂钩

53

53家企业在2020年因在ESG议题行动及披露滞后，而被贝莱德投票否决

67

67家发表支持种族平等声明的标普100企业被纽约审计局要求披露多元共融信息

“从2020年1月1日至2020年9月30日， 2030亿美元流入ESG相关投资。新冠肺炎疫情在全球的蔓延在某种程度上加速了这种转变...ESG整合是最受欢迎的可持续投资的方法...75%的全球受访者目前使用或将考虑使用ESG整合以便将可持续性概念纳入他们的投资组合。 ”

《可持续发展成为主流 - 2020年全球可持续投资调查》 贝莱德报告，2021

- 投资者希望获得具有一致性及高质量的信息，以阐述企业长期创造价值的战略性计划。
- 其他利益相关方，包括客户、监管机构及非政府组织，也对透明度提出更高的要求。 美国证券交易委员会关于审计委员会职责的申明中已经包含ESG的关键指标。

32

评级要求： ESG投资和评级体系日臻成熟， 引领型中国企业ESG评级亟待需从“入门”到“卓越”， 提升公司融资优势

欧洲专业机构 SustainAbility 2021年发表了 《2020年度ESG评级机构评分》

调研对象：

- 13家资产管理公司： AGF、Arabasque、Generation Investment Management、Glitterman Wealth Management、Hermes、JP Morgan Chase、Manulife 、 NN Investment Partners、Schroders、Skagen、Storebrand、UBS、WHEB Assent Management
- 500+投资人
- 60% 来自欧洲、 24%来自北美、 16%为其它国家和地区

核心发现

- 投资者会通过企业ESG评级、与被投企业的直接接触、内部研究和企业ESG报告来获 取企业相关的ESG信息
- 大多数投资者每周至少使用一次ESG评级。他们也会经常使用一个以上的ESG评级， 而获得尽可能多的信息
- 对ESG评级机构选择最重要的因素包括评级所涵盖的公司数量、评级方法的质量和披露，对重大问题的关注问题，数据来源的可信度，以及研究团队的经验。

评级机构名称	国别	评级参考性排名	
		● 投资人组	◆ ESG专业人员组
MSCI	美国	3	4
CDP	英国	2	2
SUSTAINALYTICS	荷兰	1	3
S&P	美国	4	1

MSCI 被动评级，全面性强，被资本市场使用最多

CDP 主动评级，质量认可度高，但有披露有局限性

S&P Global Ratings 主动评级，全面性强，被使用仅次于MSCI

SUSTAINALYTICS 被动评级，企业可操作性差，评级基于公开披露

33

备受瞩目：全球能源绿色转型和可持续发展进入关键期，资本市场对光伏行业的 ESG期许与关注居高不下

头部ESG评级机构评估范围对比

评级机构	环境	社会	治理
SUST.（荷兰）	• 土地使用和生物多样性； • 废水废物排放； • 运营碳排放 • 供应链资源利用	• 人权； • 人力资源； • 产品质量管理； • 职业健康与安全 • 数据隐私和安全	• 商业道德； • 公司治理 • 贪污受贿
CDP（英国）	• 气候变化； • 水安全； • 森林	NA	NA
MSCI（美国）	• 清洁技术的机会； • 水资源压力	• 人力资本发展； • 争议采购	• 公司治理； • 公司行为
S&P（美国）	• 环境政策与管理体系； • 运营相关的生态效益； • 气候战略	• 人才吸引与保留； • 人力资本发展； • 创新管理； • 产品责任 • 产品质量与召回管理； • 供应链管理	• 企业管治； • 重大性； • 风险及危机管理； • 商业行为准则； • 政策影响； • 税务策略

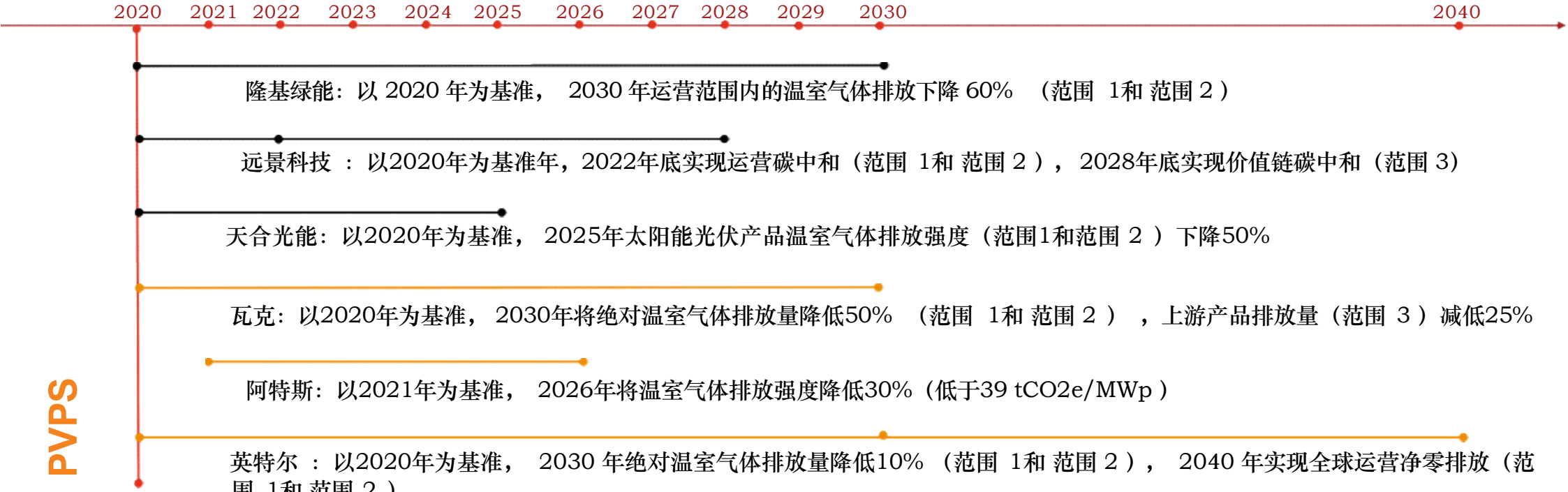
隆基及同业评级表现

#	企业名称	MSCI	S&P	CDP	SUS.
1	英特尔	AA	68	气候变化 (B)	17.0 (低风险)
2	阳光电源	A	41	NA	25.0 (中风险)
3	隆基绿能	BBB	23	气候 C 水 B-	30.0 (高风险)
4	天合光能	BB	NA	NA 未受邀	31.2 (高风险)
5	TCL中环	BB	13	F 未回复	39.3 (高风险)
6	通威股份	CCC	21	NA 未受邀	46.6 (极高风险)

MSCI ESG 指数得分表现

行业脱碳：在全球绿色低碳转型和双碳目标的背景下， 国内外新能源企业陆续出 台碳中和时间表及路线图， 脱碳成为一致行动

2020年9月22日，我国提出了碳达峰、碳中和的目标，为积极响应国家政策，缓解全球变暖带来的极端气候影响， 国内外新能源企业陆续发布碳中和行动计划，明确减碳目标，采取实际减排行动推进绿色低碳转型。



2.1 Continue to Turn Laboratory Technology into Scalable Products

Using a 20% conversion efficiency cell as a baseline, every **1%** increase in conversion efficiency reduces downstream power plant costs by roughly **5%**. Even if efficiency gains appears insignificant, every last bit makes a world of difference!

PVPS

HJT

2681 Concept Product

LONGi achieved a 26.81% mono-crystalline silicon cell efficiency and took the first step towards the industrialization of scientific and technological accomplishments.

HPBC

Hi-MO 6

Monofacial module provide aesthetic visuals with stunning performance to distributed markets.

HPDC

Hi-MO 7

Bifacial module, for centralized scenarios: especially suitable for desert Gobi with high albedo and high environmental temperature.