

“一带一路” 国家及地区电力绿色低碳转型研究

Green Transition of Power Sector in Countries and Regions of the Belt and Road Initiative

--- 聚焦南亚

With a focus on South Asia

绿色创新发展研究院

Institute for Global Decarbonization Progress

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汇报内容 Content



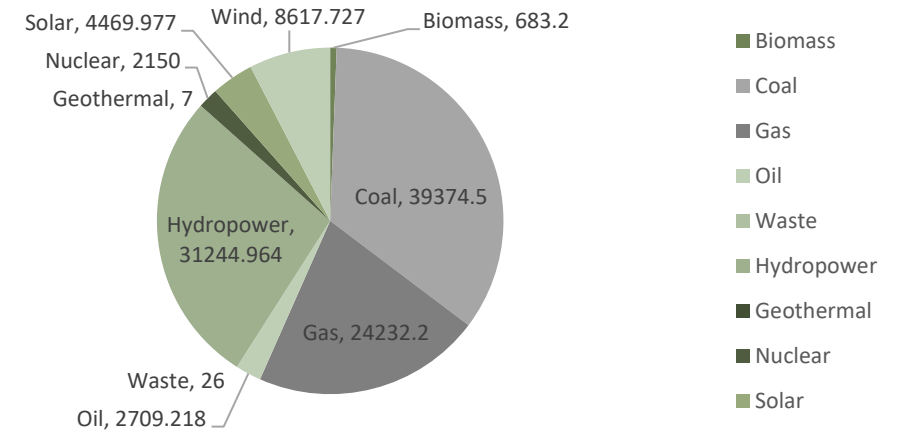
- 研究背景与产出 Research Background and Output
- 国别分析结果 Analyses for six BRI countries
- 结论 Conclusion

中国海外电力投资现状

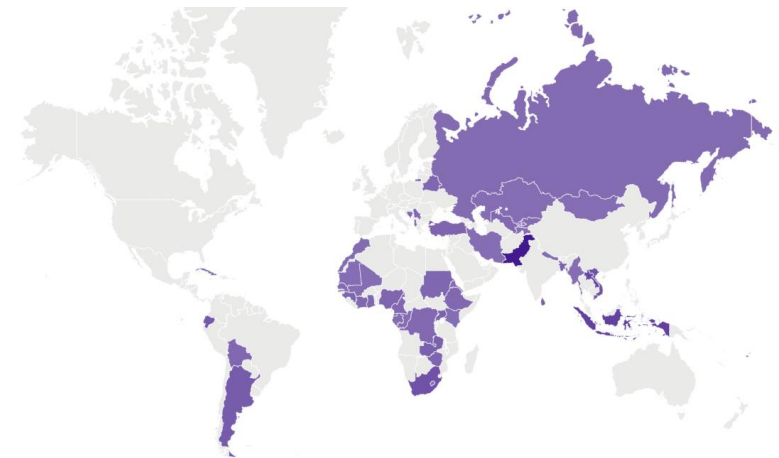
Chinese Oversea Power Investment: Status

根据BU GDP Center数据，我国政策银行和公司总计在92个国家投资了171.6GW的1423个发电机组。其中113.5GW已经投产，**从电源结构来看35%为煤电机组，28%为水电，21%为气电，风光发电合计占比12%。**

According to BU GDP Center's data, China's policy banks and companies have financed 171.6 GW of generation capacity across 1,423 power units in 92 countries, 113.5GW is already operational. **Coal takes up 34% of capacity, followed by hydro's 29%, gas (18%), solar and wind combined (12%).**



Capacity Mix of Power Plants Invested by China



China's Global Energy Finance in Power Generation (BRI countries)
Lenders: China Development Bank (CDB) and Export-Import Bank of China (CHEXIM)
Picture: BU Global Development Policy Center

数据来源Source: BU GDP Center, Jan 2022

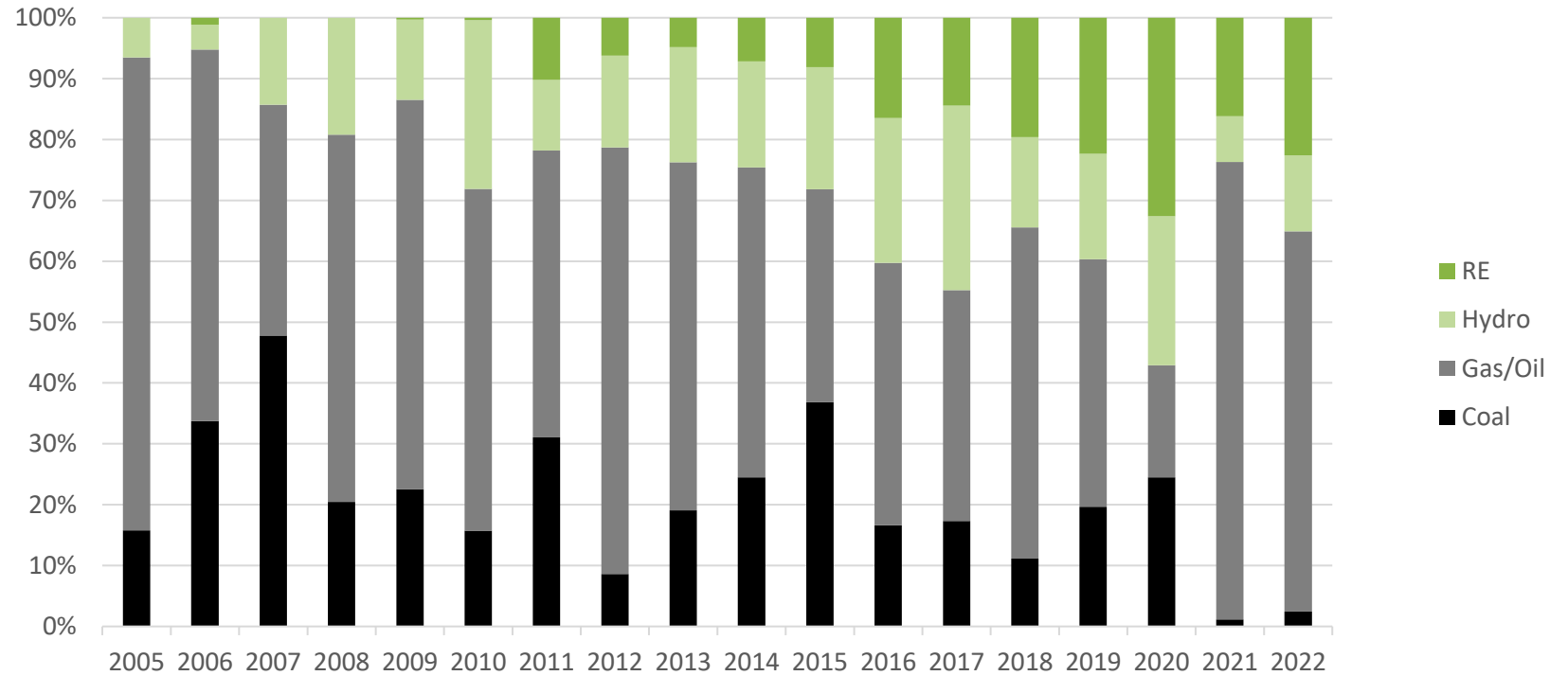
说明Note: project status might have changed since the time of data acquisition.

中国海外电力投资现状

Chinese Oversea Power Investment: Status

中国海外电力投资中对可再生电力投资呈现明显增长趋势。
The share of investment towards renewable energy from China has shown an evident increase over the past decades.

Structure of Investment (\$) by Technology Type



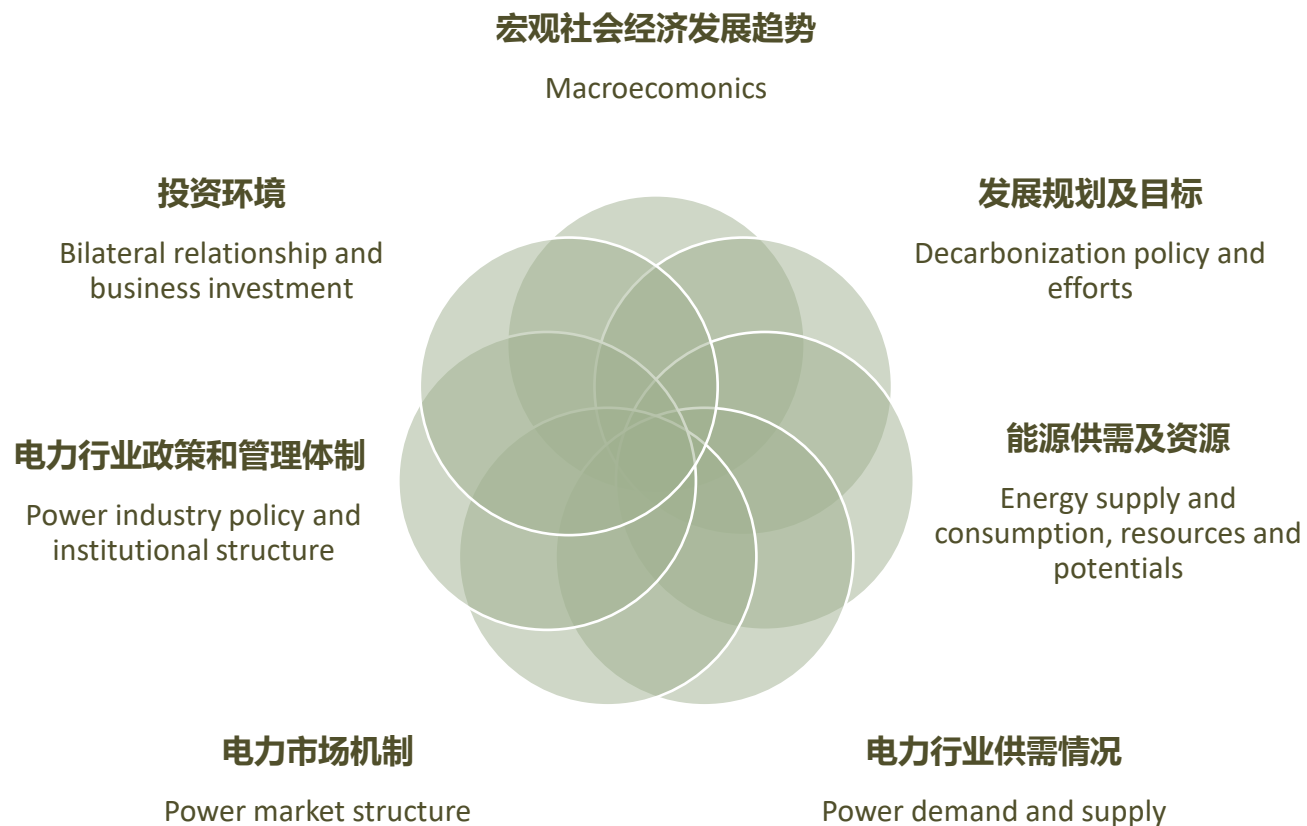
研究产出 Research Output

数据库及框架

Indicator framework of database

引导中国在带路国家的电力绿色投资，
发挥中国推动带路国家能源绿色低碳转
型的作用

Strengthen the role of China's BRI
investment in accelerating BRI countries'
low-carbon power development



71个指标覆盖经济能源
电力7大维度

71 indicators covering
seven dimensions

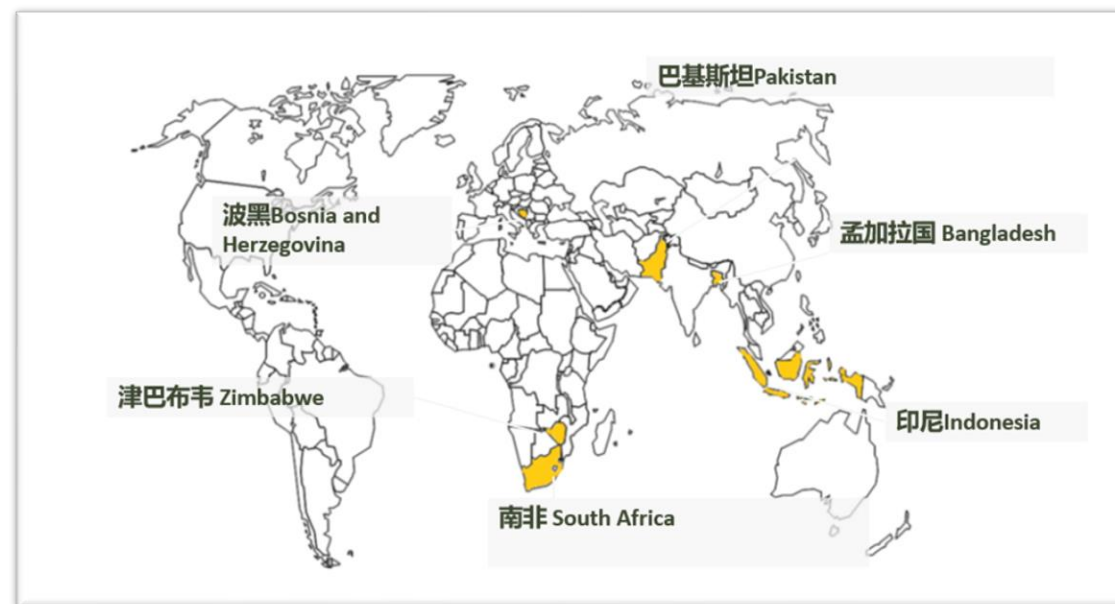
研究产出 Research Output “一带一路”六国分析报告

Report on Country Analysis of Power Investment for the 6 BRI Countries



国家选择

Selecting representative countries



报告可通过iGDP官网下载：igdp.cn/wp-content/uploads/2023/05/20230428_IGDP-Report_一带一路六国电力行业绿色低碳化分析.pdf。

Available for download on iGDP website.



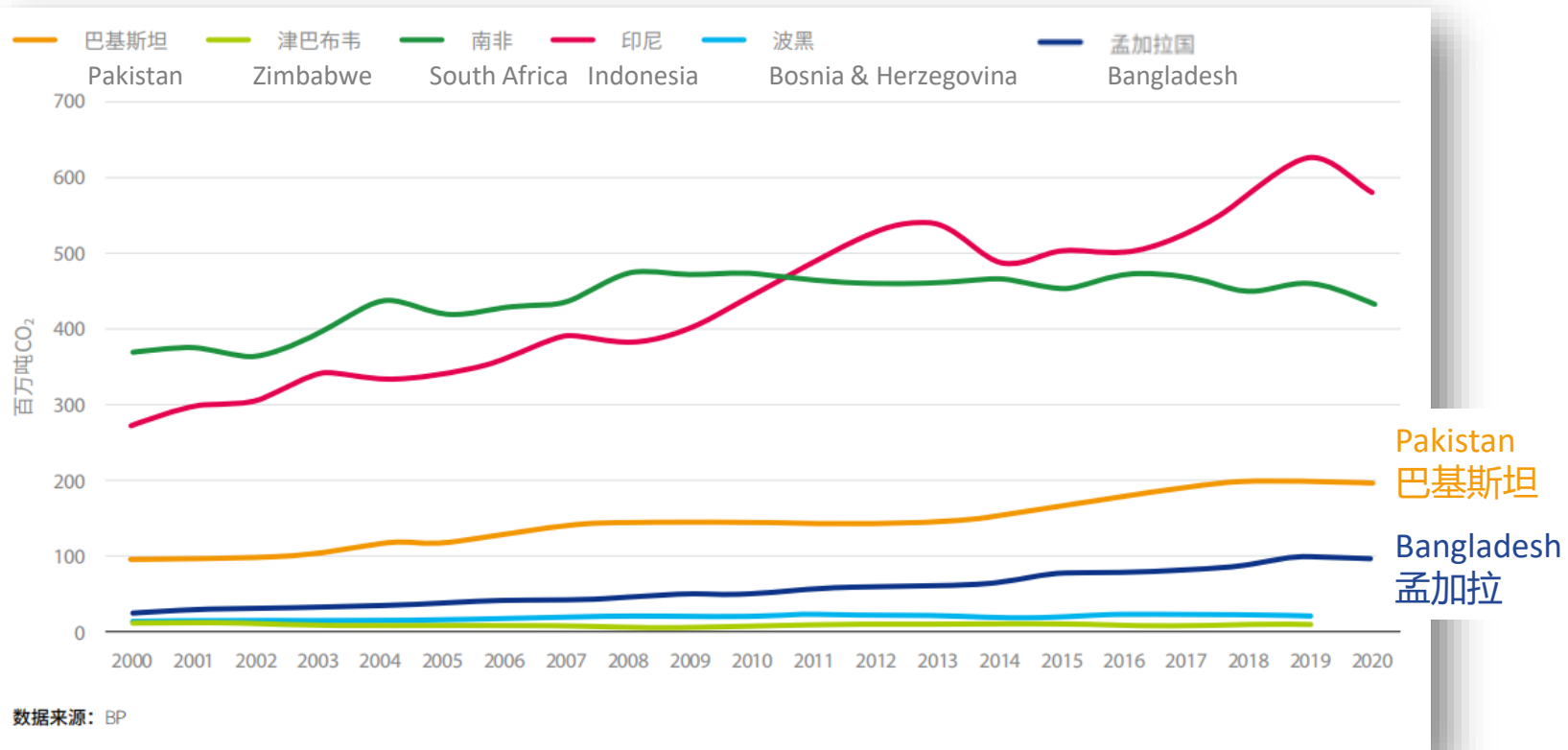
国家分析

Analyses of 6 six representative BRI countries based on the established research framework

*以下数据及分析基于数据库及国别分析报告部分内容总结。
Analysis demonstrated below are summarized based on part of
database and country analysis.*

二氧化碳排放趋势

Carbon Emissions

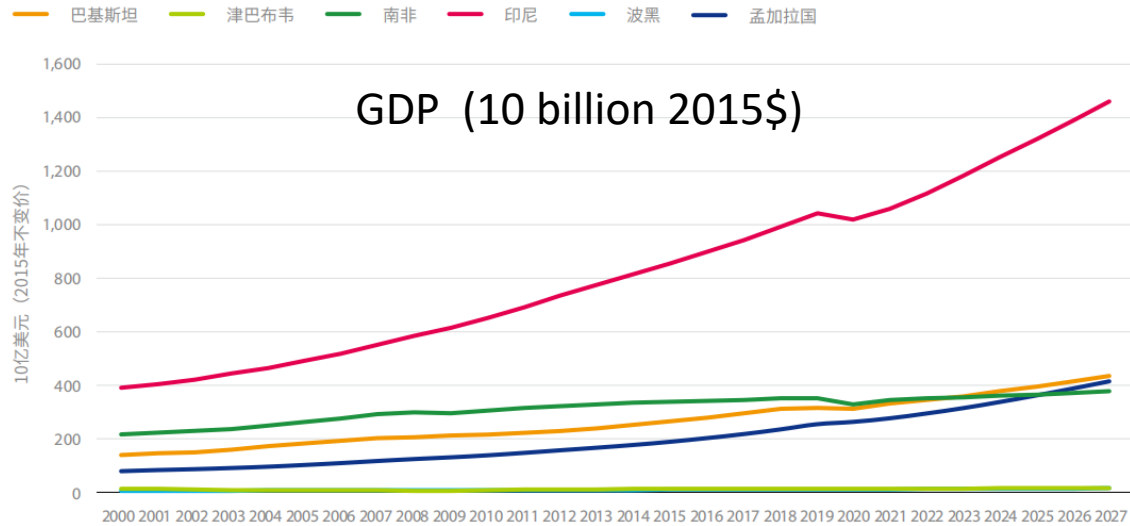


- 三个亚洲国家排放增长明显，巴基斯坦和孟加拉的排放增速低于印尼。
- The three Asian countries saw obvious increase in emission trends, among which PA and BA grows at slower rate compared to ID.

经济人口发展趋势对比

Economic development

- 孟加拉国、巴基斯坦、印尼经济规模与人口基数大且增长强劲。
- ID, BD, and PK have large population and economies, both of which will see significant growth.



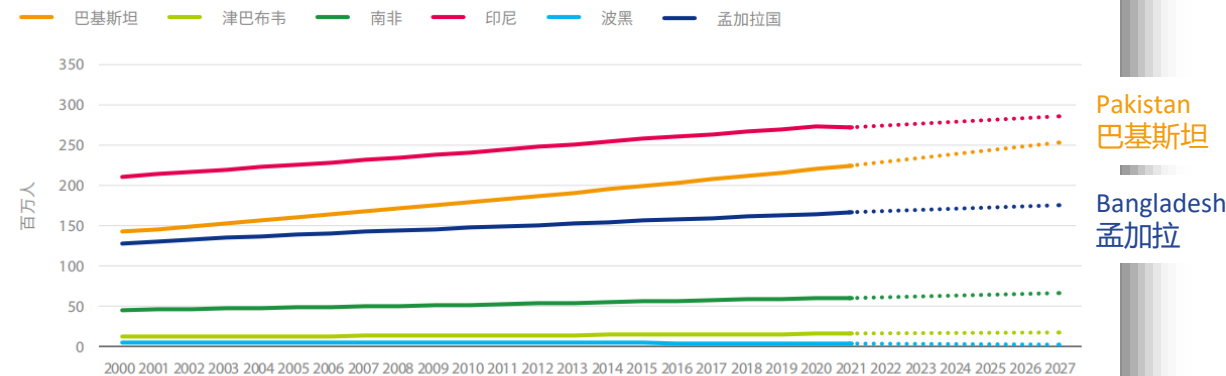
Pakistan
巴基斯坦

Bangladesh
孟加拉

数据来源: 世界银行和IMF

Population 人口 (百万人)

图2. 六国人口增长趋势 (2000年-2027年)



Pakistan
巴基斯坦

Bangladesh
孟加拉

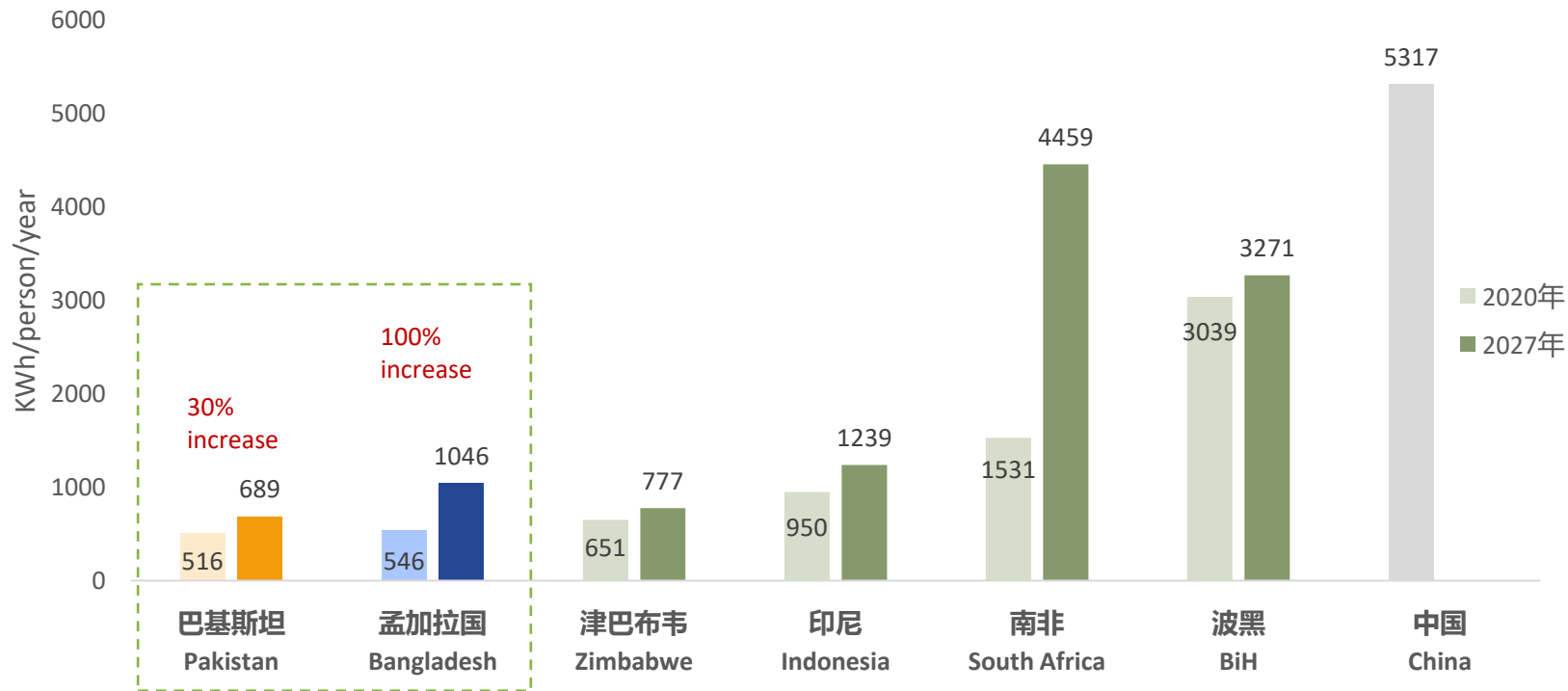
数据来源: 世界银行和IMF

电力需求现状与趋势

Power demand

人均用电量 (2020及2027年预测)

Electricity consumption per capita (2020 and 2027 projection)

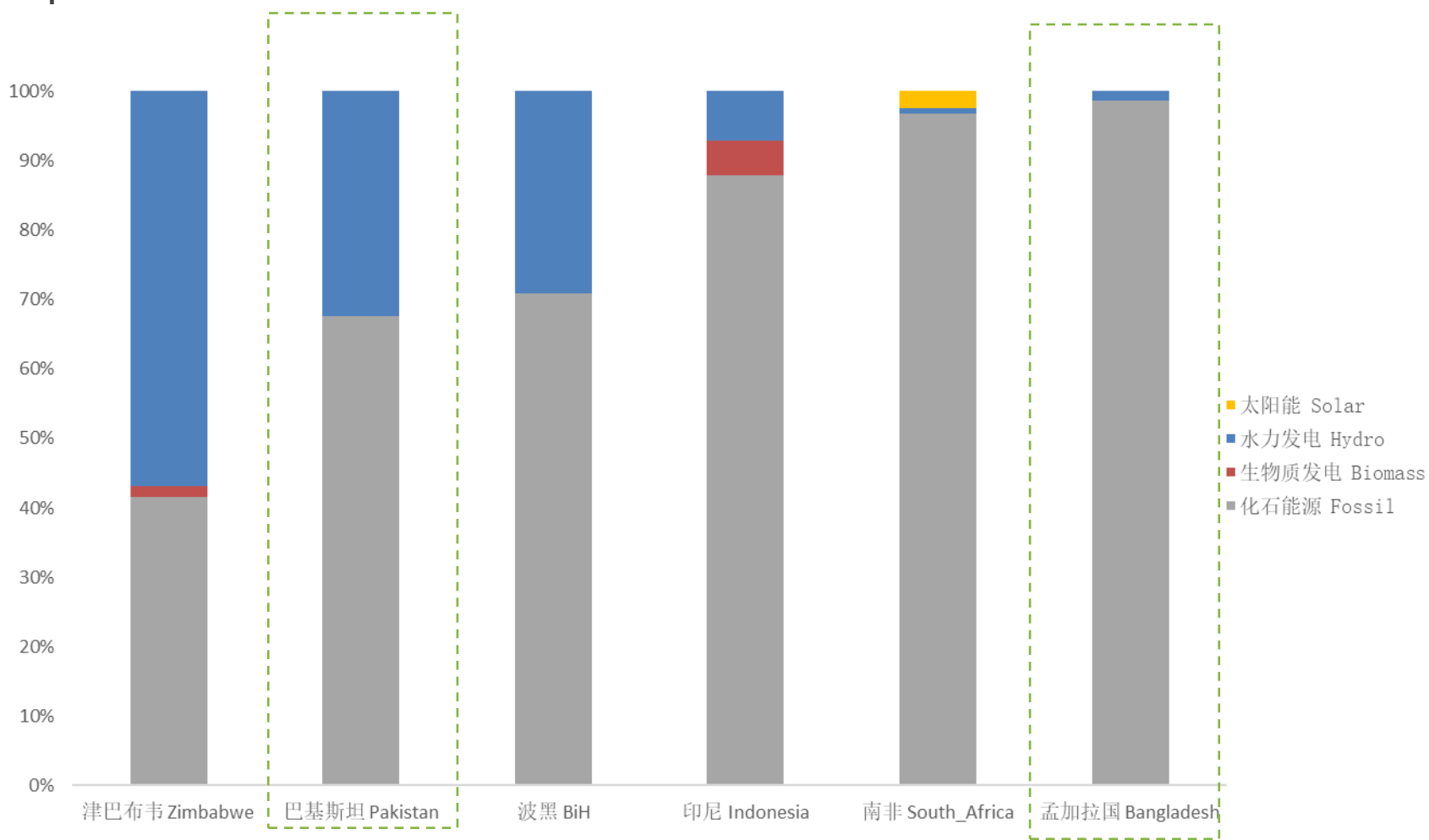


人均用电量低于中国，远低于美国等发达国家，发展空间巨大。

Electricity consumption per capita of all 6 countries are lower than that of China and significantly lower than developed countries such as the U.S., indicating significant growth opportunity, ESPECIALLY in Pakistan and Bangladesh

现有电源结构 (2020): 化石能源占比较大, 可再生能源发电占比较低

Power generation mix in 2020: pronounced dependence on fossil fuel and low level of RE penetration.



巴基斯坦水电占比较大

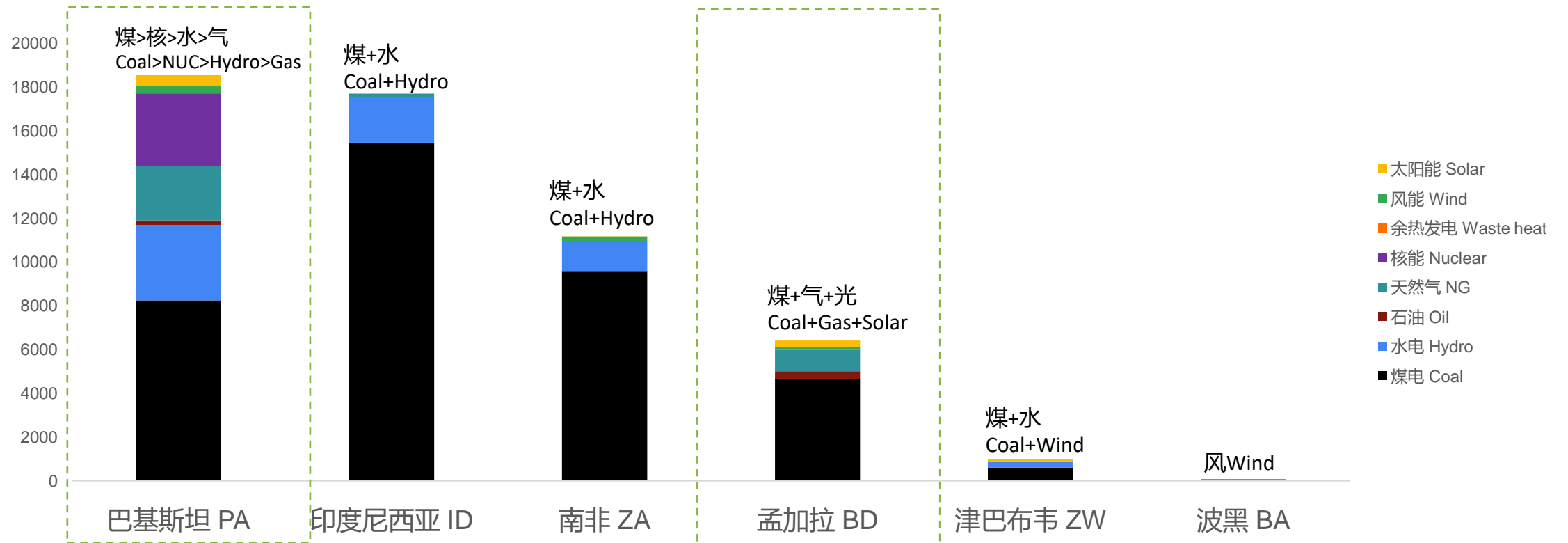
Hydroelectricity takes up more than 30% of generation in Pakistan.

中国目前在六国均以煤电投资为重，在巴基斯坦、孟加拉国、南非、波黑有一定可再生投资。

China has invested in coal power plants in the 6 countries and more RE in PK, BD, ZA and BA.

中国直接或政策银行投资的海外电力装机量 (MW)

Installed capacity invested through Chinese direct investment or by EXIM/CDB (MW)



Source: BU China Global Power DB, including operating, under construction and planned power plants. BA coal power plants has been handed over to BA.

国别分析之孟加拉国

Country analysis summary: Bangladesh

增长趋势 Development

经济人口增长迅速，电力需求增长空间巨大

With rapidly growing economy and population, there's huge potential for growth in power demand

电力供应现状 Current Power Supply

目前电力供应以燃气和燃油电厂为主，煤电较少，清洁电力占比很低。

Current power generation is primarily gas-fired power, with small coal power and RE.

能源转型主要挑战 Challenges

- 可再生资源有限，大型水电资源有限，可用土地有限。
- 目前市场化程度比较低，碳税等措施虽然有计划但尚且没有实施。
- Limited clean energy resources and available land
- Highly regulated power market and lack of tools like carbon tax and carbon market

气候雄心及额外努力 Climate goals efforts and distance

2030年可再生能源占比30%，政府出台举措促进风光发电的发展。但目前发电量结构中清洁能源仅为3%，与目标差距很大。

RE will account for 30% in 2030. The government has introduced some initiatives to promote the development of wind and solar power generation. However, the current power generation mix is only 3% clean energy, which is far from the target

资源禀赋 Resource & potential

风光资源非常有限，大型水电资源有限。化石能源后劲不足
Limited RE resources and fossil fuel resources (NG production has peaked and declined)

电力转型重点和机遇 Key area and opportunities in power industry transition

- 长期来看：分布式电源（光伏）等
- 科学发展核电，邻国进口更多进口水电及相应电网基础设施
- Distributed power (e.g. photovoltaic)
- Cautious development of nuclear power, import more hydropower from neighboring countries and improve the grid infrastructure

国别分析之巴基斯坦

Country Analysis: Pakistan

发展 Development

经济社会持续中高速发展。 中等偏下收入国家，人口规模全球排名第5，产业结构高度依赖于农业和低端服务业，未来5年GDP和人口增速预测为5%左右、2%左右。**未来电力消费需求较大。**

The economy and society continue to develop at a medium to high rate. It is a lower middle-income country with the 5th largest population in the world and an industrial structure highly dependent on agriculture and low-end services. GDP and population growth rates forecasted to be around 5% and 2% in the next 5 years. The future electricity demand is large.

资源禀赋 Resources & Potential

- **化石能源资源相对匮乏**
- **水电丰富（但波动性增加），风能、太阳能等资源丰富。**

Fossil energy resources are relatively scarce, and wind, solar and other hydropower resources are abundant.

电力供应 Current Power Supply

电力行业由化石燃料发电主导。 发电量构成：火电（61.76%），水电（27.02%），核电（7.72%），**非水可再生能源（3.15%）。**

The power sector is dominated by fossil fuel generation. Composition of power generation: thermal (61.76%), hydro (27.02%), nuclear (7.72%), non-water renewables (3.15%).

气候雄心 Climate goals

- **政府承诺加速非水可再生能源发展，并完全禁止进口煤炭。**
- **2025和2030年，非水可再生能源发电量占比为20%和30%。** 2020年起暂停新煤电厂。
- **The government is committed to accelerating the development of non-water renewable power and banning coal imports.**
- **The goal for non-water renewable power generation in 2025 and 2030 is 20% and 30% respectively.** a moratorium on new coal plants from 2020

主要挑战 Challenges

- **发电设施和电网系统落后，输配电损失高（发电量19%），有效供给不足，稳定性有待改善。**
- **电力系统循环债务问题是电力投资的主要风险之一。**
- The issue of circular debt in the power system is one of the main risks of power investments.
- The power generation facilities and grid system are outdated, with inefficient power generation and high transmission and distribution losses.

电力转型重点和机遇 Key area and opportunities in power industry transition

电力行业转型需要尽快发展**可再生能源项目、电网设施建设、煤电淘汰等相关领域等，将产生巨大投资需求。**

Energy transition investment needs are huge. Investment needs of \$101 billion by 2030 and an additional \$65 billion by 2040 for renewable energy projects, transmission and distribution network construction, coal power phase-out and renewable energy-related areas.

地区特点观察

Observations

- **经济与电力需求增长 Economic and electricity demand growth :**
南亚发展中国家经济、人口、工业将有较快发展，推动**电力需求的快速增长**。
- **电力行业转型趋势 Trends in power sector transformation :**
两国均提出了明确的可再生能源发展目标，且均有一定可再生资源禀赋，清洁能源发展潜力很大。**但政策的可持续性和落实是关键**。
- **市场化工具 Electricity markets :**
发展中国家电力**市场化程度普遍不高**，大多为单一购买者模式，但独立发电商以及其在可再生电力发展中的角色正在加强。市场化工具的发展大多在起始阶段。
- **基础设施发展需求 Demand for Enhanced Infrastructure :**
许多发展中国家电力供给落后于需求增长速度（如孟加拉国），面临电力供应短缺问题或者有效电力供应不足的问题（如巴基斯坦），也面临着随着可再生电力渗透率的提升可再生消纳问题，因此**加快完善电网设施将是发展及转型的必要需求**。
- **分布式电力发展需求 Distributed power generation :**
分布式电力尤其是光伏在发展中国家有相对重要的地位，一方面可以帮助解决大电网建设周期较长，而现有电力需求需要更及时的响应；另一方面可以帮助解决受到用地限制的影响，难以开发大型可再生项目的问题（如孟加拉国和印尼的一些岛屿）。
- **公正转型 Just transition :**
6国电源结构中化石能源占比均较大，部分经济发展水平相对较高的煤炭大国（南非、印尼）相应提出了退煤和其他气候目标，以及煤炭公正转型的相关举措。其他煤炭/化石行业较发达的国家也可借鉴减少煤炭退出带来的潜在影响。

感谢专家们的批评与建议！
Thank you for your time and suggestion!