



# China's Global Power Database Methodological Note

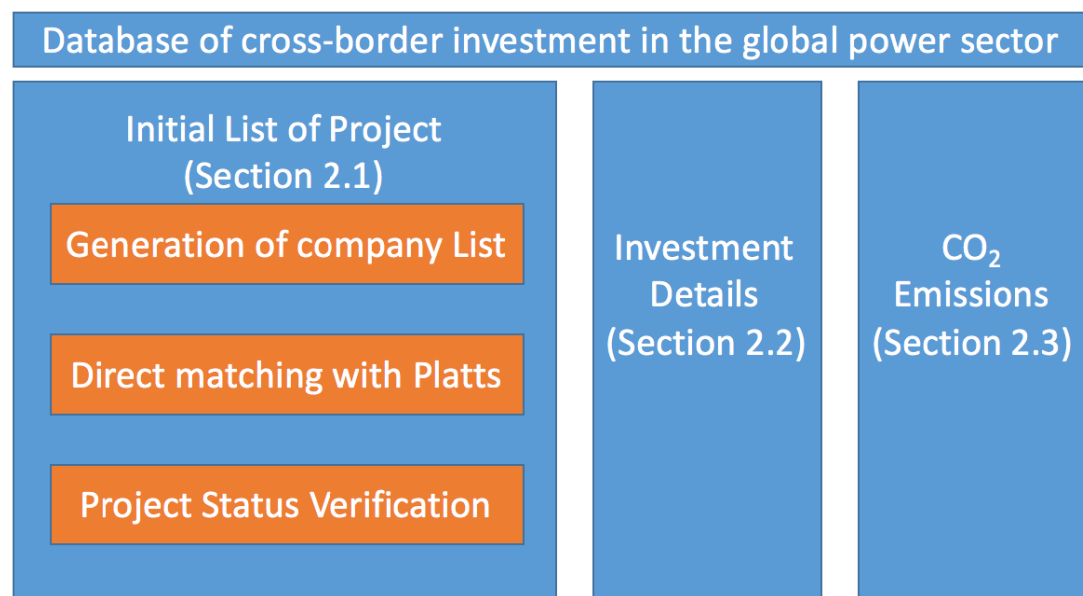
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## 1 Overview of the Database

The China's Global Power (CGP) database records all power projects around the world involving Chinese capital, including foreign direct investment (FDI) and public finance through Chinese national development bank and export-import credit agency. All project attributes can be categorized into three sections. The first section includes the fundamental information about the status of the power plant, such as its name, location, capacity, technology type, the year of commission, and estimated carbon dioxide emissions for fossil plants. The second section includes information on if the project involves Chinese foreign direct investment, such as the name of Chinese investor, whether the project is greenfield or M&A, and the share of Chinese investment in the project. The third section includes information on if the project receives Chinese public finance, such as the loan provider and recipient. A detailed list of the project attributes can be found in the appendix. The data collection processes for projects involving foreign direct investment is different from the projects involving Chinese policy finance. Their methodologies are described separately in section 2.

## 2 Methodology of Data Collection for FDI Projects

Figure 1 shows an overview of the methodology for our database. Section 2.1 discusses how we generated the initial list of projects through three steps. Section 2.2 and 2.3 discuss how we expanded the initial list of projects to include investment details and carbon dioxide emissions for every project on the list.



**Figure 1. Methodology overview**

### 2.1 The initial project list from S&P World Electric Power Plants Database

The Global China Initiative undertakes a three step process to identify Chinese foreign direct investment in the power sector using a variety online databases and public reports, some which are propriety to the GDP Center's GCI. First, we build upon existing databases to identify an aggregate list of potential data entries for our master dataset. We further corroborate this information and fill missing gaps through a unique algorithmic approach that we apply to the WEPP database. The following details the three step process that we pursue to generate our unique database.

### 2.2 Generation of company list

For each country of our interest (China in the case of CGP), we first generate a list of power companies that may invest globally by surveying a wide variety of online databases and public reports. Four online databases are intensively utilized, including FDiMarket (2017), Dealogic (2017), Coal Plant Tracker (2017), and Global Coal Exit List (2017). Combining these sources, we create an initial list of companies that we consider to be potential investors in foreign power markets. Detailed lists of



companies can be found in the appendix. We acknowledge that there could be more missing companies, especially small to medium-sized private companies.

### **2.3 Direct matching with S&P WEPP database**

After compiling the list of firms that invest globally in the power sector, we then match the names on our company list with companies listed in the S&P WEPP database. We use a simple matching algorithm that searches the S&P WEPP database for names of firms in our company list and variations thereof. For every company, we generate one to three keywords that are representative of all possible names that WEPP uses for the company. We tag power plants with the name of a holding company when at least one of the keywords are found in the WEPP database indicating it is the original owner. We then put all of the power plants obtained via this matching process together into a new list. Examples of keywords are included in the appendix. It should be noted that the coverage of renewable power projects in WEPP is much less comprehensive than non-renewable power projects. Therefore, such a top-down approach based on the WEPP database could likely underestimate cross-border investment in the global renewable power sector.

### **2.4 Project status verification**

A power plant project can take as long as a decade from its announcement to the day it starts operating. Many announced projects end up canceled or delayed and an incorrect recording of foreign outward investment could wrongly include these “zombie deals.” The most famous example is the Myitsone hydroelectric power project in Myanmar. In 2009, \$3.6 billion USD of investment was announced but it was never realized, as the project has been suspended since 2011. Inclusion of such zombie projects would lead to an overestimation of cross-border investment. In this database, we rely on the project status information provided by WEPP, which records power plants as in operation, under construction, under planning, deferred, canceled or retired. We only include projects that are in operation, under construction, or under planning as valid investments. Investments at other project stages are excluded to avoid zombie deals.

In addition, we also validate every investment by Internet searches to avoid false matches. Website links are included in the database. Since every investment is traced down to the power plant level and is given a unique project ID, double counting is avoided.

### **2.5 Investment details**

Investment details include three attributes: the name of the foreign investor, the share of the investor in the project, the country of origin of the investor, and the year of the investment. The name of the foreign investor comes from direct matching, as well as its country of origin. When there are more than one foreign investors in



the same project, we split the project into multiple rows of data. For every row, the basic information for the project is the same, while the investors are different. For the share of the investor, we collect the information through Internet searches.

While the entire power plant development process could also take years to finish, it is difficult to define and track the exact date when the initial investment is made. The WEPP database, however provides comprehensive data on the year in which projects start operating (commission date). Therefore, although investments precede commission dates by years, due to lack of a viable alternative, we use the year in which projects commence operation as the year of the investment.

## 2.6 CO<sub>2</sub> Emissions

For every fossil-based power project, we calculate its expected annual carbon dioxide emissions, using the equation below:

$$\text{Annual CO}_2 \text{ emissions (kton/year)} = \text{plant capacity (MW)} \times \text{capacity factor} \times 8760 \text{ (hours/year)} \times \text{emission factor (g/kWh)/}10^6 \text{ (kton-to-kg conversion factor)}$$

Plant capacity is the gross generating capacity of the plant. Capacity factor is assumed to be 60% for all power plants. For emissions factor, we use the matrix developed by Tong et al., 2018.<sup>1</sup> It provides region-specific emissions factors for coal, gas, and oil power plants while taking into account different steam types, sizes of the plant, and qualities of fuel. The original matrix can be found in the appendix.

## 3 Methodology of data collection for policy bank projects

Project information for projects involving Chinese policy banks – the China Development Bank (CDB) and Export-Import Bank of China (Exim Bank) are taken from the 2019 version of China’s Global Energy Finance database compiled by the Global Development Policy Center at Boston University. The data is collected from public sources. Methodology can be found at <http://www.bu.edu/gdp/files/2018/08/Coding-Manual-.pdf>.

<sup>1</sup> Tong, D. et al. Targeted emission reductions from global super-polluting power plant units. *Nature Sustainability* 1, 59–68 (2018).



## 4 Appendix

### 4.1 List of project attributes

Attribute	Definition
Project Name	Name of the power plant
Capacity (MW)	Gross generating capacity of unit (MW)
Project Status	Operational or under construction.
Year of Commission*	Year unit entered or is scheduled for commission
Technology	Primary fuel: Coal, gas, solar, wind, etc.
State	State or province where the plant is located
Country	Country where the plant is located
Region	Region where the plant is located
Estimated Annual CO <sub>2</sub> Emission	Estimated annual CO <sub>2</sub> emissions (kton)
Deal Type	M&A, greenfield investment, involves both FDI and policy banks, or just policy bank finance
FDI	Involving Chinese foreign direct investment or not
Investing Company	Primary Chinese investor
Ownership %	The share of ownership held by the primary Chinese investor
Policy Bank	Involving Chinese policy banks or not
Lender	Which Chinese policy bank provided the loan
Borrower	Primary recipient of the loan
Source	Online weblinks

### 4.2 List of companies and keywords for direct matching

Company Name	Keyword 1	Keyword 2	Keyword 3
A-Power Energy Generation Systems	A-POWER	A-POWER	A-POWER
A-TECH Wind Power (Jiangxi) Co Ltd	A-TECH	A-TECH	A-TECH
Advanced Technology & Materials Co Ltd	ADVANCED TECH	ADVANCED TECH	ADVANCED TECH
Alpha Energy Storage Solution	ALPHA ESS	ALPHA ENERGY STORAGE	ALPHA-ESS
Aluminium Corporation of China (Chinalco) (Chalco)	ALUMINIUM CORPORATION OF CHINA	CHALCO	CHINALCO
Asia Pacific Generation	ASIA PACIFIC GENERATION	ASIA PACIFIC GENERATION	ASIA PACIFIC GENERATION
Asia Tiger Group Ltd	ASIA TIGER	ASIA TIGER	ASIA TIGER
Aviation Industry Corporation of China	CHINA AVIATIOIN IND	AVIATION INDUSTRY CORPORATION OF CHINA	AVIATION INDUSTRY CORPORATION OF CHINA
Beijing DQY Agriculture Technology	DQY	DEQINGYUAN	DEQINGYUAN
Beijing Enterprises Holdings Ltd	BEIJING ENTERPRISES	BEIJING ENTERPRISES	BEIJING ENTERPRISES
Beijing Fuxing Xiaocheng Electronic Technology Stock	FUXING XIAOCHENG	FUXING XIAOCHENG	FUXING XIAOCHENG

Company Name	Keyword 1	Keyword 2	Keyword 3
Beijing Jingneng Clean Energy Co Ltd	JINGNENG	JINGNENG	JINGNENG
Beijing Ruichi Power Technology	RUICHI POWER	BEIJING RUICHI	RUICHI POWER
Boretech	BORETECH	BORETECH	BORETECH
Boyuan Construction Group Inc	BOYUAN	BOYUAN	BOYUAN
BYD	BYD	BYD	BYD
Canadian Solar Inc	CANADIAN SOLAR	CANADIAN SOLAR	CANADIAN SOLAR
Changzhou Almaden	CHANGZHOU ALMADEN	CHANGZHOU ALMADEN	CHANGZHOU ALMADEN
Chaozhou Three-Circle Group Co Ltd	CHAOZHOU THREE	CCTC	THREE-CIRCLE
China Aerospace Science and Technology Corporation	CHINA AEROSPACE	CHINA AEROSPACE	CHINA AEROSPACE
China CAMC Engineering	SINOMACH	CAMC	CAMC
China Certification & Inspection (CCIC)	CHINA CERTIFICATION	CCIC	CHINA CERTI
China Crystal Technologies	CHINA CRYSTAL TECH	CHINA CRYSTAL TECH	CHINA CRYSTAL TECH
China Development Bank Corp	CDB	CHINA DEVELOPMENT BANK	CHINA DEVELOPMENT BANK
China Energy Conservation and Environmental Protection Group (Cecep)	CECEP	CHINA ENERGY CONS	CHINA ENERGY CONS
China Everbright Group	CHINA EVERBRIGHT	CHINA EVERBRIGHT	CHINA EVERBRIGHT
China General Nuclear Power Corporation (China Guangdong Nuclear Power Holding)	GENERAL NUC	CGNPC	CHINA GENERAL NUC
China General Technology Group	CHINA GENERAL TECH	CHINA GENERAL TECH	CHINA GENERAL TECH
China Gezhouba (CGGC)	GEZHOUBA	CGGC	GEZHOUBA
China Guodian Corporation	GUODIAN	GUODIAN	GUODIAN
China Huadian Corporation	HUADIAN	HUADIAN	HUADIAN
China Huaneng	HUANENG	HUANENG	HUANENG
China International Trust & Investment Corp - CITIC	CITIC	CITIC	CITIC
China Investment Corp	CHINA INV	CHINA INV	CHINA INV
China Juli Group	CHINA JULI	JULI GROUP	JULI GROUP
China Longyuan Power Group Corp Ltd	LONGYUAN	LONGYUAN	LONGYUAN
China Machinery Engineering Corp	CMEC	CHINA MACHINERY	CHINA MACH ENG
China Metallurgical Group Corporation (MCC)	CHINA METALLURGICAL	MCC	CHINA METAL
China Ming Yang Wind Power Group	MINGYANG	MINGYANG	MINGYANG
China Minsheng Investment Corp	MINSHENG	MINSHENG	MINSHENG
China National Building Material Group Corporation (CNBM)	CHINA NATIONAL BUILDING MATERIAL	CNBM	CHINA NATL BUILD
China National Chemical (ChemChina)	CHINA NATL CHEM	CHINA NATIONAL CHEM	CHEMCHINA
China National Electric Engineering	CHINA NATIONAL ELECTRIC ENG	CHINA NATL ELEC	CNEEC
China National Machinery Industry	CHINA NATIONAL MACH	SINOMACH	CHINA NATL MACH



Company Name	Keyword 1	Keyword 2	Keyword 3
China National Materials Company	CHINA NATL MAT	CHINA NATIONAL MAT	CHINA NATIONAL MAT
China National Nuclear Corporation	CHINA NATL NUC	CNNC	CHINA NATIONAL NUC
China National Offshore Oil Corporation (CNOOC)	CHINA NATIONAL OFFSHORE OIL	CNOOC	CHINA NATL OFFSHORE
China National Overseas Engineering (Covec)	CHINA NATIONAL OVERSEAS ENGINEERING	COVEC	CHINA NATL OVERSEAS ENG
China National Petroleum (CNPC)	CHINA NATIONAL PETROLEUM	CNPC	CHINA NATL PETRO
China National Seed Group	CHINA NATIONAL SEED	CHINA NATIONAL SEED	CHINA NATIONAL SEED
China Natural Gas	CHINA NATURAL GAS	CHINA NATURAL GAS	CHINA NATURAL GAS
China Oceanwide Holdings Ltd	OCEANWIDE	OCEANWIDE	OCEANWIDE
China Petroleum and Chemical (Sinopec)	CHINA PETRO	SINOPEC	SINOPEC
China Poly	CHINA POLY	CHINA POLY	POLY GROUP
China Power Investment	CHINA POWER INVESTMENT	CHINA POWER INV	CPI
China Railway Construction Corporation	CHINA RAILWAY CONS	CRCC	CHINA RAIL CONS
China Solar Photovoltaic	CHINA SOLAR PV	CHINA SOLAR PHOTO	CHINA SOLAR PV
China Southern Power Grid	CHINA SOUTHERN POWER GRID	CHINA SOUTHERN POWER GRID	CHINA SOUTH POWER GRID
China Sunergy	CHINA SUNERGY	CHINA SUNERGY	CHINA SUNERGY
China Three Gorges Corporation	THREE GORGES	THREE GORGE	THREE GORGE
China Wanhe Investment Ltd	WANHE	WANHE	WANHE
China Western Power Industrial	CHINA WESTERN POWER	CHINA WESTERN POWER	CHINA WESTERN POWER
Chinaland Solar Energy	CHINALAND	CHINALAND	CHINALAND
Chint Group	CHINT	CHINT	CHINT
Clenergy International	CLENERGY	CLENERGY	CLENERGY
CNPV Solar Power (CNPV)	CNPV SOLAR	CNPV	CNPV
Cochran International Holdings	COCHRAN INT	COCHRAN INT	COCHRAN INT
CSEIC	CHINA SINOGY ELECTRIC	CSEIC	CSEEC
Daqo New Energy	DAQO	DAQO	DAQO
Datang International Power Generation	DATANG	DATANG	DATANG
Divine Aid Enterprise Tianjin International Trade	DIVINE AID	TIANJIN INT	DIVINE AID
Dongfang Electric (DEC)	DONGFANG ELECTRIC	(DEC)	DONGFANG ELEC
Dongfang Electrical Machinery	DONGFANG ELECTRIC MACHINERY	(DEFM)	DONGFANG ELECTRIC MACHINERY
Dragon Power	DRAGON POWER	DRAGON POWER	DRAGON POWER
ELL Environmental Holdings Ltd	ELL ENV	ELL ENV	ELL ENV
ENN Group	ENN GROUP	ENN GROUP	ENN GROUP
Envision Energy	ENVISION ENERGY	ENVISION ENERGY	ENVISION ENERGY
Eoply New Energy Technology	EOPLLY	OUBEI	EOPLLY



Company Name	Keyword 1	Keyword 2	Keyword 3
Erjin Solar Energy Equipment Making	ERJIN SOLAR	ERJIN SOLAR	ERJIN SOLAR
ET Solar	ET SOLAR	ET SOLAR	ET SOLAR
Excel Fortune	EXCEL FORTUNE	EXCEL FORTUNE	EXCEL FORTUNE
Flat Glass Group	FLAT GLASS	FLAT GLASS	FLAT GLASS
Focusic	FOCUSIC	FOCUSIC	FOCUSIC
Fortunate Solar Technology	FORTUNATE SOLAR	FORTUNATE SOLAR	FORTUNATE SOLAR
GC China Turbine Corp	GC CHINA	GC CHINA	GC CHINA
GCL New Energy Holdings Ltd	GCL	GCL	GCL
GCL-Poly Energy Holdings Ltd	GCL-POLY	GCL-POLY	GCL-POLY
GI Technologies (Beijing)	GI TECH	GI TECH	GI TECH
Ginkgo Tree Investment Ltd	GINGKO	GINGKO	GINGKO
Golden Jumping Group	GOLDEN JUMPING	GOLDEN JUMPING	GOLDEN JUMPING
GS Solar	GS SOLAR	GS SOLAR	GS SOLAR
GSR Ventures; Dragontech Ventures Management Ltd	GSR VENTURE	DRAGONTECH VENTURE	DRAGONTECH VENTURE
Guangdong Aiko Solar Energy Technology Co Ltd	AIKO SOLAR	AIKO SOLAR	AIKO SOLAR
Guangdong Hengjian Investment Holdings Co Ltd	HENGJIAN INV	HENGJIAN INV	HENGJIAN INV
Guangxuan High-tech Group	GUANGXUAN	GUANGXUAN	GUANGXUAN
Guangzhou Devotion Thermal Technology	DEVOTION	DEVOTION	DEVOTION
Guangzhou Felicity Solar Technology	FELICITY	FELICITY	FELICITY
Guanxi Estates	GUANGXI ESTATES	GUANGXI ESTATES	GUANGXI ESTATES
Guanxi State Farm	GUANGXI STATE FARM	GUANGXI STATE FARM	GUANGXI STATE FARM
Halo International	HALO INT	HALO INT	HALO INT
Hanergy Holdings Group	HANERGY	HANERGY	HANERGY
Hanwha SolarOne (Solarfun Power)	HANWHA SOLARONE	SOLARFUN	SOLARFUN
Harbin Electric	HARBIN ELEC	HARBIN ELEC	HARBIN ELEC
Hareon Solar Technology	HAREON	SHENLONG	HAREON
Heilongjiang Lijing Industry Co Ltd	HEILONGJIANG LIJING	HEILONGJIANG LIJING	HEILONGJIANG LIJING
Hejian Solidkey Petroleum Machinery	HEJIAN SOLIDKEY	SOLIDKEY PETRO	SOLIDKEY PETRO
Honghua Group	HONGHUA	HONGHUA	HONGHUA
Hope Group (Beijing Hope Solar Power)	HOPE GROUP	HOPE SOLAR	BEIJING HOPE
Huapeng	HUAPENG	HUAPENG	HUAPENG
Huawei Technologies	HUANGWEI	HUANGWEI	HUANGWEI
Huayi Electric	HUAYI ELEC	HUAYI ELEC	HUAYI ELEC
JA Solar	JA SOLAR	JA SOLAR	JA SOLAR
Jetion Solar Holdings	JETION SOLAR	JETION SOLAR	JETION SOLAR
Jiangsu Baoli Asphalt	JIANGSU BAOLI	BAOLI ASP	JIANGSU BAOLI





Company Name	Keyword 1	Keyword 2	Keyword 3
Jiangsu Changbao Steel Tube	CHANGBAO	CHANGBAO	CHANGBAO
Jiangsu Communication Clean Energy Technology (CCETC)	Jiangsu Communication Clean Energy Technology	Jiangsu Communication Clean Energy Technology	CCETC
Jiangsu Hantong Group	JIANGSU HANTONG	HANTONG GROUP	HANTONG
Jiangsu Kaiyuan Group	JIANGSU KAIYUAN	JIANGSU KAIYUAN	JIANGSU KAIYUAN
Jiangsu Shunda Semiconductor Development	SHUNDA SEMICONDUCTOR	SHUNDA SEMICONDUCTOR	SHUNDA SEMICONDUCTOR
Jiangsu Sujia Group	JIANGSU SUJIA	JIANGSU SUJIA	JIANGSU SUJIA
Jiexiu Dexinglong Coal Gasification	JIEXIU DEXINGLONG	JIEXIU DEXINGLONG	JIEXIU DEXINGLONG
JinkoSolar	JINKOSOLAR	JINKOSOLAR	JINKOSOLAR
Jinpan International	JINPAN INTERNATIONAL	JINPAN INTERNATIONAL	JINPAN INTERNATIONAL
KINETIC POWER & ENERGY	KINETIC POWER	KINETIC POWER	KINETIC POWER
Kinglong New Energy Technology (KLNE) (Beijing Kinglong New Energy Technology)	KINGLONG	KINGLONG	KINGLONG
LDK Solar	LDK SOLAR	LDK SOLAR	LDK SOLAR
Lightway Solar	LIGHTWAY SOLAR	LIGHTWAY SOLAR	LIGHTWAY SOLAR
Linuo Group	LINUO	LINUO	LINUO
Mingyang Electric	MINGYANG ELECTRIC	MINGYANG ELECTRIC	MINGYANG ELEC
Nanjing Sunec Wind Generator Equipment Factory	NAJING SUNEK	NAJING SUNEK	SUNEK WIND
Narada Power	NARADA POWER	NARADA POWER	NARADA POWER
New Sky (China) Environmental & Tech Co Ltd	NEW SKY	NEW SKY	NEW SKY
Ningbo Shentong Auto Decorations Ltd	SHENTONG	SHENTONG	SHENTONG
Niutech Environment Technology	NIUTECH	NIUTECH	NIUTECH
Oriental Energy	ORIENTAL ENERGY	ORIENTAL ENERGY	ORIENTAL ENERGY
Pansoft	PANSOFT	PANSOFT	PANSOFT
Polar Photovoltaics	POLAR PHOTO	POLAR PV	POLAR PV
Power Construction Corporation of China (PowerChina)	POWERCHINA	POWER CONSTR CORP	POWER CONSTRUCTION CORP
Powerway Renewable Energy	POWERWAY	POWERWAY	POWERWAY
Private Investor (Mr. Ko Chun Shun, Johnson)	PRIVATE INVESTOR	PRIVATE INVESTOR	PRIVATE INVESTOR
Profundo Technologies	PROFUNDO	PROFUNDO	PROFUNDO
Prudent Energy	PRUDENT ENERGY	PRUDENT ENERGY	PRUDENT ENERGY
PT Drive	PT DRIVE	PT DRIVE	PT DRIVE
Qingdao iTechene Technologies	ITECHENE	ITECHENE	ITECHENE
Qingdao Talent Tradiog	QINGDAO TALENT	QINGDAO TALENT	QINGDAO TALENT
Qunsheng Group	QUNSHENG	QUNSHENG	QUNSHENG
R.D. Green Source Chemical	R.D. GREEN SOURCE	GREEN SOURCE CHEMICAL	GREEN SOURCE CHEM



Company Name	Keyword 1	Keyword 2	Keyword 3
Recon Technology	RECON TECH	RCON TECH	RECON TECH
ReneSola	RENESOLA	RENESOLA	RENESOLA
Risen Energy	RISEN ENERGY	RISEN ENERGY	RISEN ENERGY
Sancon Resources Recovery	SANCON RESOURCES RECOVERY	SANCON RES	SANCON RES
Sany	SANY	SANY	SANY
Seraphim Solar System	SERAPHIM	SERAPHIM	SERAPHIM
Shandong Borun Process Industrial Technology	SHANDONG BORUN	BORUN HYDRO	SHANDONG BORUN
Shandong Hi-speed Group Co Ltd	SHANDONG HI-SPEED	SHANDONG HI-SPEED	SHANDONG HI-SPEED
Shandong Kerui Group	SHANDONG KERUI	SHANDONG KERUI	SHANDONG KERUI
Shangdong Auhua	SHANGDONG AUHUA	SHANGDONG AUHUA	SHANGDONG AUHUA
Shanghai Alex Solar Industry	ALEX SOLAR	ALEX SOLAR	ALEX SOLAR
Shanghai Alliance Investment Ltd; Valero Energy Corp; Bohemian Investment Corp; I2BF Venture Capital; Infield Capital; Southern Ute Alternative Energy LLC	SHANGHAI ALLIANCE	SHANGHAI ALLIANCE	SHANGHAI ALLIANCE
Shanghai Chaori Solar Energy Science & Technology	CHAORI	CHAORI	CHAORI
Shanghai Electric	SHANGHAI ELEC	SHANGHAI ELECTRIC	SHANGHAI ELECTRIC
Shanghai Guyuan Real Estate Development Co Ltd	GUYUAN	GUYUAN	GUYUAN
Shanghai Safbon Water Service	SAFBON	SAFBON	SAFBON
Shanghai Shangshi Energy Technology	SHANGSHI ENERGY	SHANGHAI SHANGSHI	SHANGHAI SHANGSHI
Shanghai Taisheng Wind Power Equipment	TAISHENG	TAISHENG	TAISHENG
Shanxi Coal International Energy Group	SHANXI COAL	SHANXI COAL	SHANXI COAL
Shenhua Group Corporation	SHENHUA	SHENHUA	SHENHUA
Shenyang Brilliant Elevator Co Ltd	SHENYANG BRILLIANT	SHENYANG BRILLIANT	SHENYANG BRILLIANT
Shenzhen Energy Group	SHENZHEN ENERGY	SHENZHEN ENERGY	SHENZHEN ENERGY
Shenzhen Nanshan Power Station Co Ltd	NANSHAN POWER	NANSHAN POWER	SHENZHEN NANSHAN
Shunfeng International Clean Energy Ltd	SHUNFENG	SHUNFENG	SHUNFENG
Simax (Suzhou) Green New Energy	SIMAX	SIMAX	SIMAX
Sinohydro	SINOHYDRO	SINOHYDRO	SINOHYDRO
Sinovel Wind	SINOVEL	SINOVEL	SINOVEL
State Development and Investment	STATE DEV	STATE DEV	SDIC
State Grid Corporation	STATE GRID	STATE GRID	STATE GRID
State Power Investment Corp	STATE POWER INV	STATE POWER INV	SPIC
Sungrow Power Supply	SUNGROW POWER	SUNGROW POWER	SUNGROW POWER
Sunlan Solar	SUNLAN SOLAR	SUNLAN SOLAR	SUNLAN SOLAR
SunSi Energies Inc	SUNSI	SUNSI	SUNSI



Company Name	Keyword 1	Keyword 2	Keyword 3
Suntech Power Holdings	SUNTECH	SUNTECH	SUNTECH
TBB Power	TBB POWER	TBB POWER	TBB POWER
Tebian Electric Apparatus (TBEA)	TEBIAN ELECTRIC	TBEA	TEBIAN ELE
Tellhow SCI-Tech Co Ltd	TELLHOW	TELLHOW	TELLHOW
The Hilong Group of Companies	HILONG GROUP	HILONG GROUP	HILONG GROUP
Tianjin Pipe	TIANJIN PIPE	TIANJIN PIPE	TIANJIN PIPE
Tianjin State Farms Agribusiness Group	TIANJIN STATE FARM	TIANJIN STATE FARM	TIANJIN STATE FARM
Tianjin Suli Cable Group	SULI CABLE	SULI CABLE	SULI CABLE
Titan Wind Energy	TITAN WIND	TITAN WIND	TITAN WIND
Tongfang (Tsinghua Tongfang)	TONGFANG	TONGFANG	TONGFANG
Topoint Photovoltaic	TOPOINT PHOTO	TOPOINT PV	TOPOINT PHOTO
Tri-Tech	TRI-TECH	TRI-TECH	TRI-TECH
Trina Solar Limited	TRINA SOLAR	TRINA SOLAR	TRINA
Union Resources & Engineering	UNION RES	UNION RES	UNION RES
United Photovoltaics Group Ltd	UNITED PHOTO	UNITED PHOTO	UNITED PHOTO
Upsolar	UPSOLAR	UPSOLAR	UPSOLAR
Wanxiang	WANXIANG	WANXIANG	WANXIANG
Winsun New Energy	WINSUN	WINSUN	WINSUN
Wiscom System Co Ltd	WISCOM	WISCOM	WISCOM
WSP Holdings Limited	WUXI SEAMLESS	WSP HOLD	WSP HOLD
Wuxi Guolian Development Group	GUOLIAN	GUOLIAN	GUOLIAN
Xi'an LONGI Silicon Materials	LONGI	LONGI	LONGI
Xiangtan Electric Manufacturing (XEMC)	XIANGTAN ELECTRIC	XEMC	XIANGTAN ELEC
Xin Gang Power Investments Ltd	XIN GANG	XIN GANG	XIN GANG
Xinfa Group	XINFA	XINFA	XINFA
Xinjiang Goldwind Science & Technology (Goldwind)	GOLDWIND	GOLDWIND	GOLDWIND
Xinjiang Guanghui Industry Investment (Group)	XINJIANG GUANGHUI	XINJIANG GUANGHUI	XINJIANG GUANGHUI
Xuzhou Superenergy Photoelectricity Technology	XUZHOU SUPERENERGY	SUPERENERGY PV	SUPERENERGY PHOTO
Yangden Solar Energy Holding	YANGDEN SOLAR	YANGDEN SOLAR	YANGDEN SOLAR
Yechiu Metal Recycling (China)	YECHIU	YECHIU	YECHIU
Yinchuan Tianjia Energy Technology	TIANJIA	TIANJIA	TIANJIA
Yingli Green Energy Holding Company Limited (Yingli)	YINGLI	YINGLI	YINGLI
Yunnan Water Investment Co Ltd	YUNNAN WATER	YUNNAN WATER	YUNNAN WATER
Zewox New Energy	ZEWOX	ZEWOX	ZEWOX
Zhefu Holding Group Co Ltd	ZHEFU	ZHEFU	ZHEFU



Company Name	Keyword 1	Keyword 2	Keyword 3
Zhejiang Glass	ZHEJIANG GLASS	ZHEJIANG GLASS	ZHEJIANG GLASS
Zhejiang Hengyi Group	ZHEJIANG HENGYI	HENGYI	HENGYI
Zhejiang Jiangnan Petrochemical Machinery (Zhejiang JNSH Machinery)	JIANGNAN PETROCHEMICAL	JNSH	JIANGNAN PETRO
Zhejiang Kaishan Compressor	KAISHAN	KAISHAN	KAISHAN
Zhejiang Kaishan Compressor Co Ltd	ZHEJIANG KAISHAN	ZHEJIANG KAISHAN	ZHEJIANG KAISHAN
Zhejiang Leye Photovoltaic Science & Technology	ZHEJIANG LEYE	LEYE PHOTO	LEYE PHOTO
Zhejiang Rongsheng Holding Group	RONGSHENG	RONGSHENG	RONGSHENG
Zhejiang Solar Best Energy Technology (Solarbest)	ZHEJIANG SOLAR BEST	SOLAR BEST	SOLAR BEST
Zhejiang Sunflower Light Energy Science & Technology (Sunowe)	ZHEJIANG SUNFLOWER	SUNOWE	SUNOWE
Zhenfa New Energy Science and Technology	ZHENFA	ZHENFA	ZHENFA
Zhongli SCI-Tech Group	ZHONGLI	ZHONGLI	ZHONGLI
ZKenergy Science & Technology	ZKENERGY	ZKENERGY	ZKENERGY
Znshine Group	ZNSHINE	ZNSHINE	ZNSHINE
ZTE	ZTE	ZONERGY	ZTE



### 4.3 Matrix for emissions factors

Coal Power Plant	
Region	CO <sub>2</sub> Emission factor (g/KWh)
China	864
India	1668
US	1015
Europe	1237
Russia	1418
Rest of Asia	959
Latin America + Canada	889
Middle East + Africa	1273
Rest of World	1157
Global	1044

Natural Gas Power Plant	
Region	CO <sub>2</sub> Emission factor (g/KWh)
China	455
India	456
US	487
Europe	453
Russia	713
Rest of Asia	566
Latin America + Canada	464
Middle East + Africa	535
Rest of World	505
Global	527

Oil Power Plant	
Region	CO <sub>2</sub> Emission factor (g/KWh)
China	211
India	1099
US	1323
Europe	782
Russia	1171
Rest of Asia	657
Latin America + Canada	660
Middle East + Africa	869
Rest of World	1248
Global	788





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*The views expressed in this coding manual are strictly those of the author(s) and do not represent the position of Boston University, or the Global Development Policy Center.*

