



# State-Owned Power Companies: The “who” in climate success

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*Public Affairs*

*CIRIEC*  
*October 27, 2023*  
*Brussels, Belgium*

# Preface

# SOEs present issues ...

- ▶ **“Controversial” economic actors**
- ▶ **“SOE reform”**



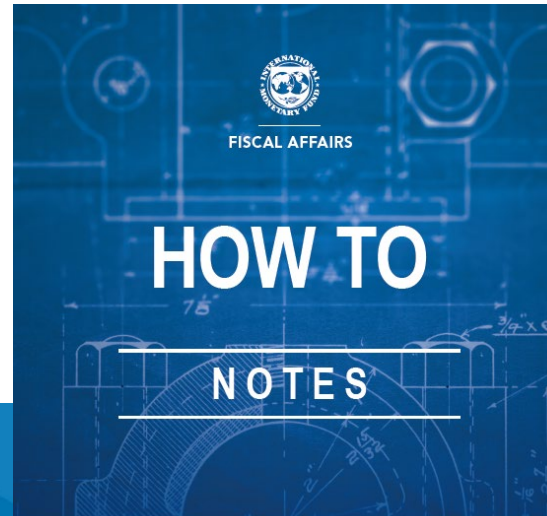
OECD Guidelines  
on Corporate Governance  
of State-Owned  
Enterprises  
2015 EDITION



Corporate Governance  
of State-Owned  
Enterprises  
A TOOLKIT


 OECD

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How to Assess Fiscal Risks from  
State-Owned Enterprises  
Benchmarking and Stress Testing

NOTE 21/09



WP/17/221

**IMF Working Paper**

State-Owned Enterprises in Emerging Europe:  
The Good, the Bad, and the Ugly

by Uwe Böwer

# Some SOEs are problematic for some ...

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FOREIGN AFFAIRS    Why America Must Lead Again

## Why America Must Lead Again

Rescuing U.S. Foreign Policy After Trump

By [Joseph R. Biden, Jr.](#)    March/April 2020

The United States does need to get tough with China. If China has its way, it will keep robbing the United States and American companies of their technology and intellectual property. It will also keep using subsidies to give its state-owned enterprises an unfair advantage—and a leg up on dominating the technologies and industries of the future.

**“How much does climate change scare you?”**

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**When it comes to tackling climate,**

**SOEs are here**

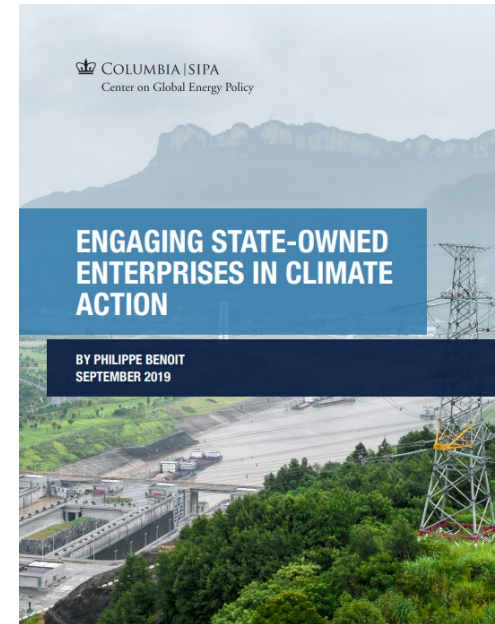
**for now**

**and tomorrow**

# Contents

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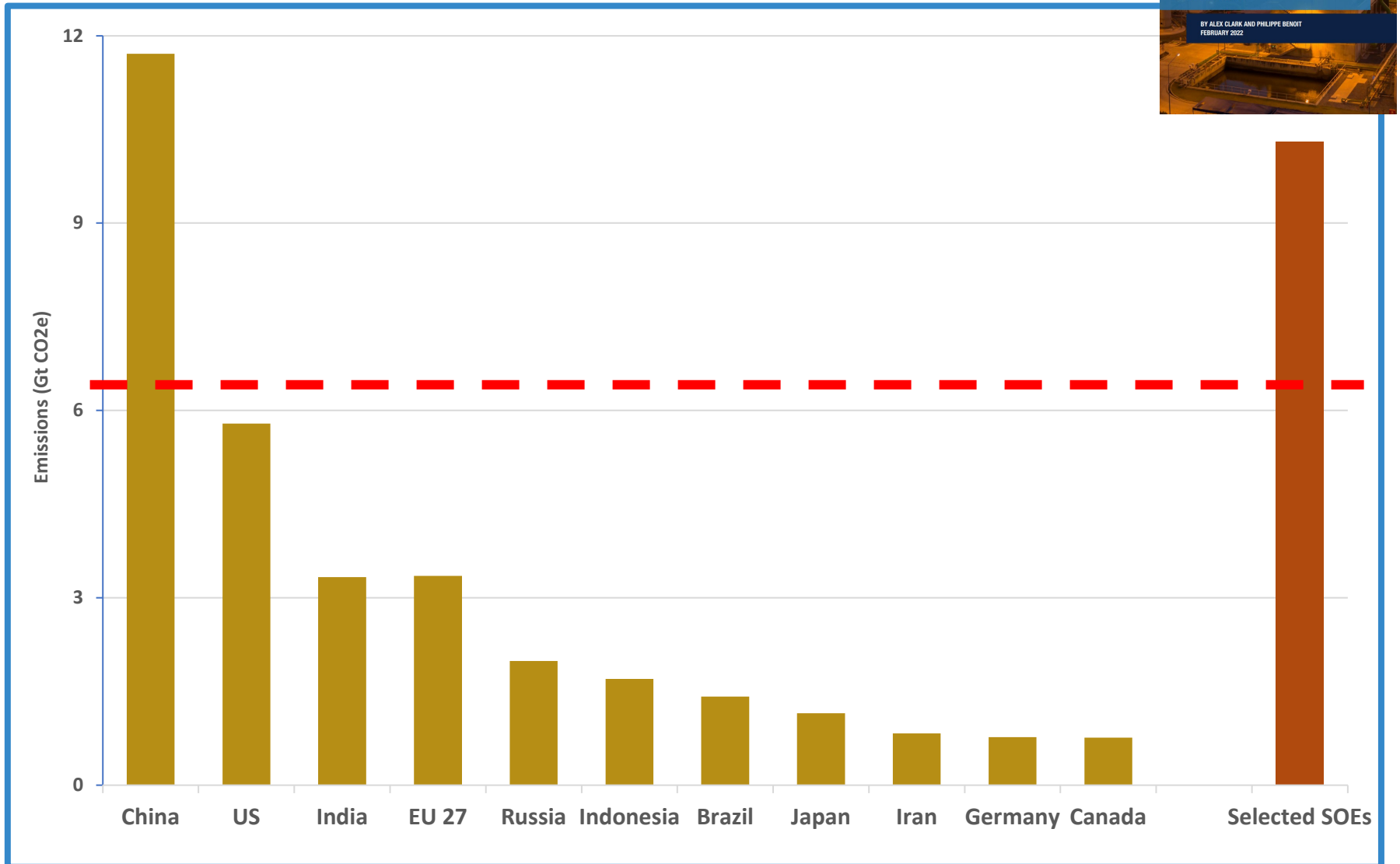
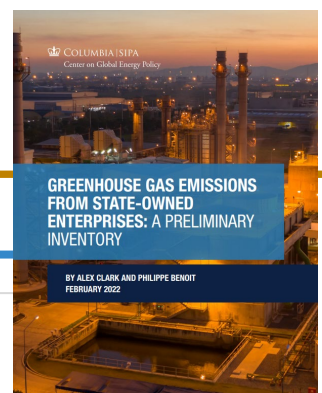
1. Why SOEs/SPCs engagement matters for climate
2. Climate Policy Implications
3. SPCs differences and policy implications
4. Analytics of Stranded Assets and LCOE for government shareholders
5. Clean energy finance: role of SPCs
6. Concluding thoughts





# SOEs are big players in energy transition

# SOEs



Source: Climate Watch, Clark/Benoit (2022)



# SOEs: Big, diverse and key to climate

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- 1. Fossil fuel producers:** NOCs, coal
  - *big Scope 3 emissions + some Scope 1 (methane, CO<sub>2</sub>)*
- 2. Power companies:** generators, grid operators, IPP purchasers
  - *big Scope 1*
- 3. Energy users:** heavy industry(cement, steel, etc.); transport (airlines, urban transport systems)
  - *some Scope 1 and 2*
- 4. Financial institutions:** state-owned banks, export credit agencies, pension funds, *MDBs*,



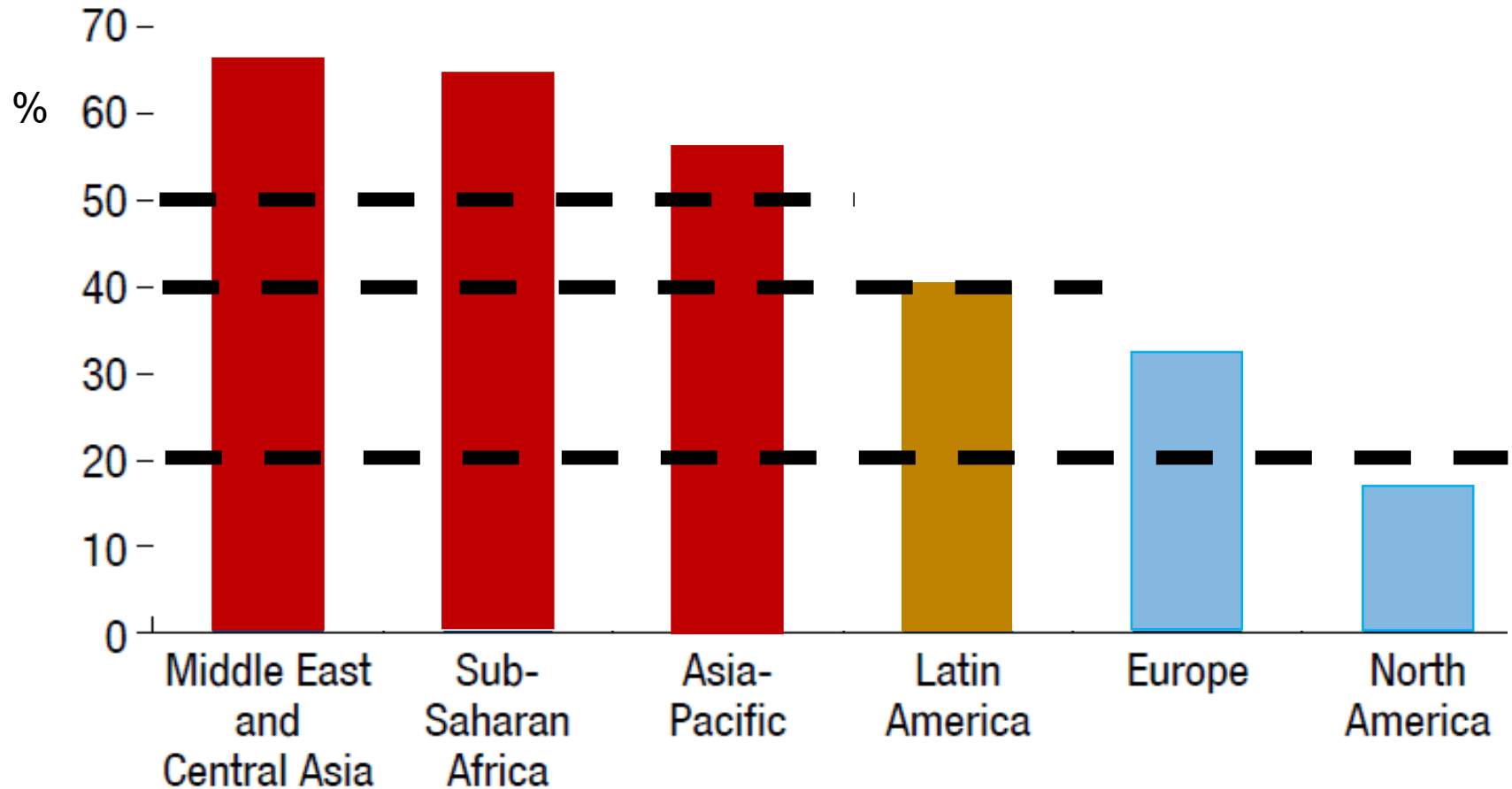
**A focus on state-owned power  
companies (SPCs):  
Major drivers of major emissions**

# SPCs: Big in a big emitting sector

	World Energy (GtCO <sub>2</sub> )	Power (GtCO <sub>2</sub> )	Share of power emissions
2020	34.8	13.5	<b>39%</b>
2040 SDS	14.7	3.2	22%
2040 NZE	5.8	0	0%

# SPCs power generation share by region

*Share of power generation capacity owned by state (2017)*



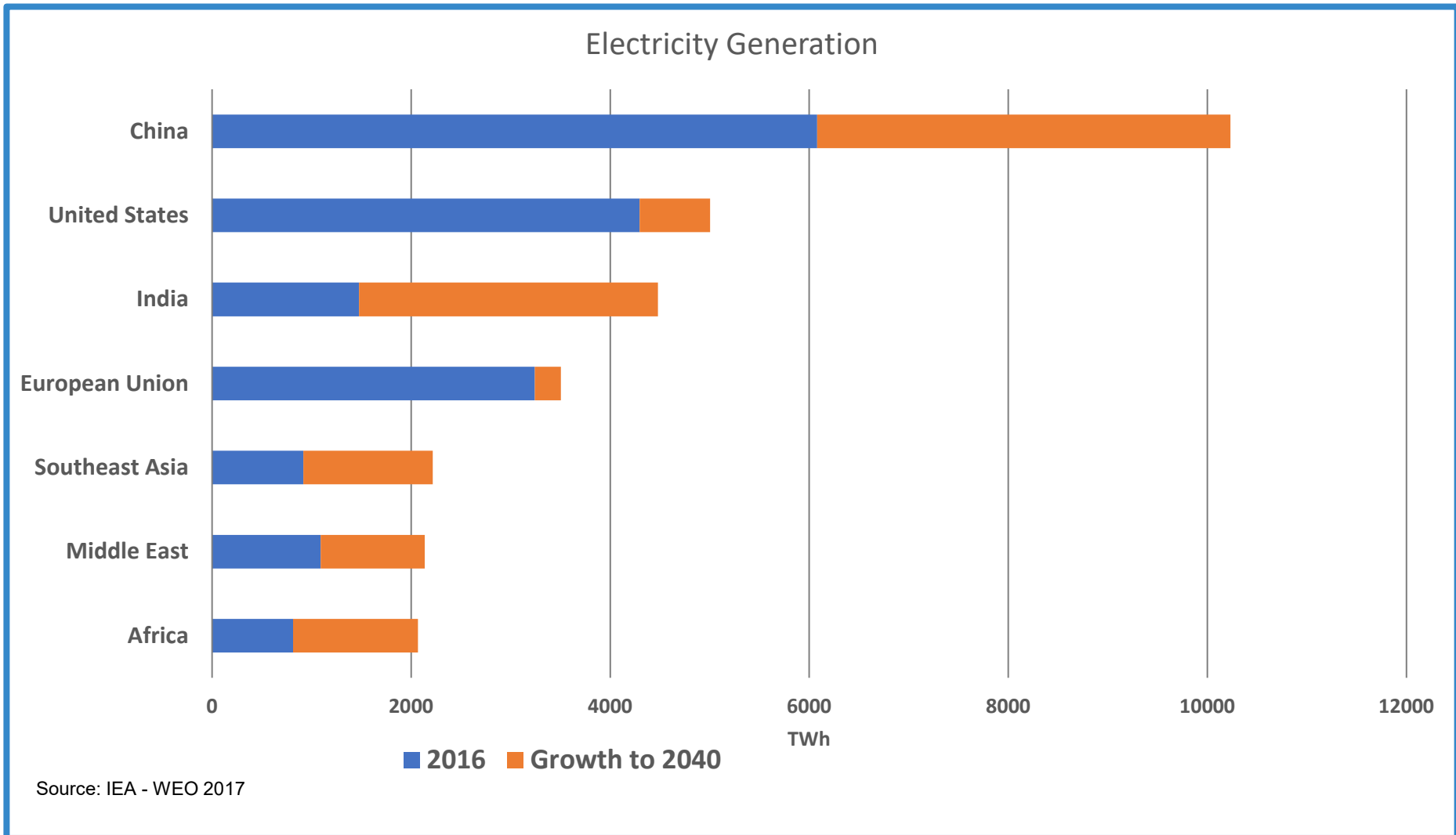
Source: IMF (2020)

# SPC-dominated regions important re: CO2

	Power	% CO2		Delta MtCO2	Effort
	2017 MtCO <sub>2</sub>	2017	2040 STEPS	'17-'40 SDS	%'17-'40 SDS
<b>Asia-Pacific</b>	7594	56	66	<b>-5313</b>	<b>55%</b>
<b>ME-CA</b>	1641	12	12	<b>-968</b>	<b>10%</b>
<b>SSA</b>	466	3	4	<b>-266</b>	<b>3%</b>
<b>LA</b>	266	2	2	<b>-207</b>	<b>2%</b>
<b>Europe</b>	1422	11	5	-1159	12%
<b>North Am</b>	2055	15	11	-1752	18%
	13444	100	100	-9665	100%

# SPCs are key to emissions

- SPCs emit nearly half of global power sector emissions (>6GtCO<sub>2</sub>)
- A share that is likely to grow



# SPCs own a large share of ...

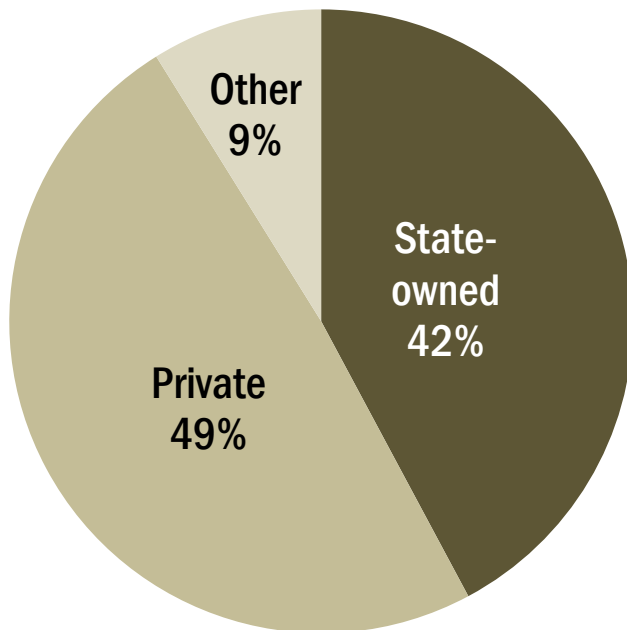


# SPCs own a large share of ...

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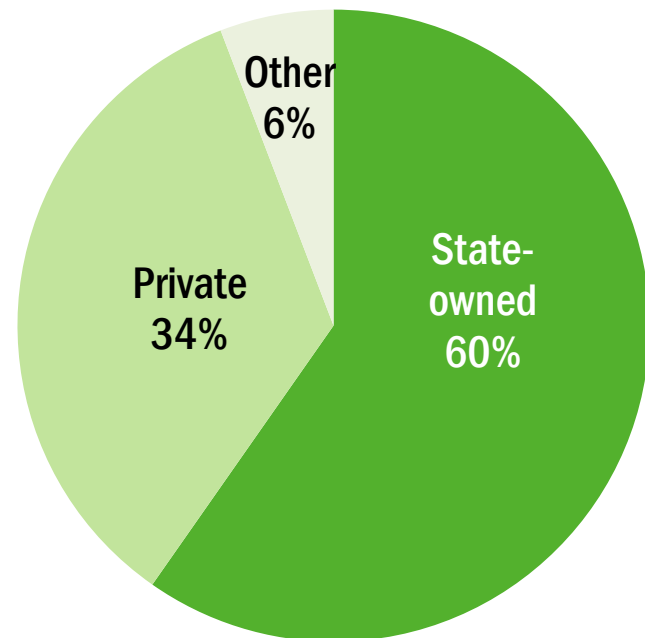
## Ownership of fossil fuel generation capacity

3 702 GW



## Ownership of 'zero-carbon' generation capacity

1 980 GW (hydropower, other utility-scale renewables and nuclear)





# SPCs: key for resilience

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**and procurers/off-takers of IPPs**



# Bespoke Climate Policies for SPCs

# SPCs differ from private sector companies

Private Shareholders



Energy Companies

- **Profit-maximization for shareholder equity**

➤ **Pricing drivers (carbon price)**

Government Shareholder



Energy Companies

- **Economic development**
- **Employment**
- **Social development**
- **Access**
- **Profit-generation**

Provincial, etc. level Shareholders



Energy Companies

➤ **Central/Prov. /Local Gov interplay**

➤ **Multiple drivers and levers**

# Influencing SPCs– a whole new world

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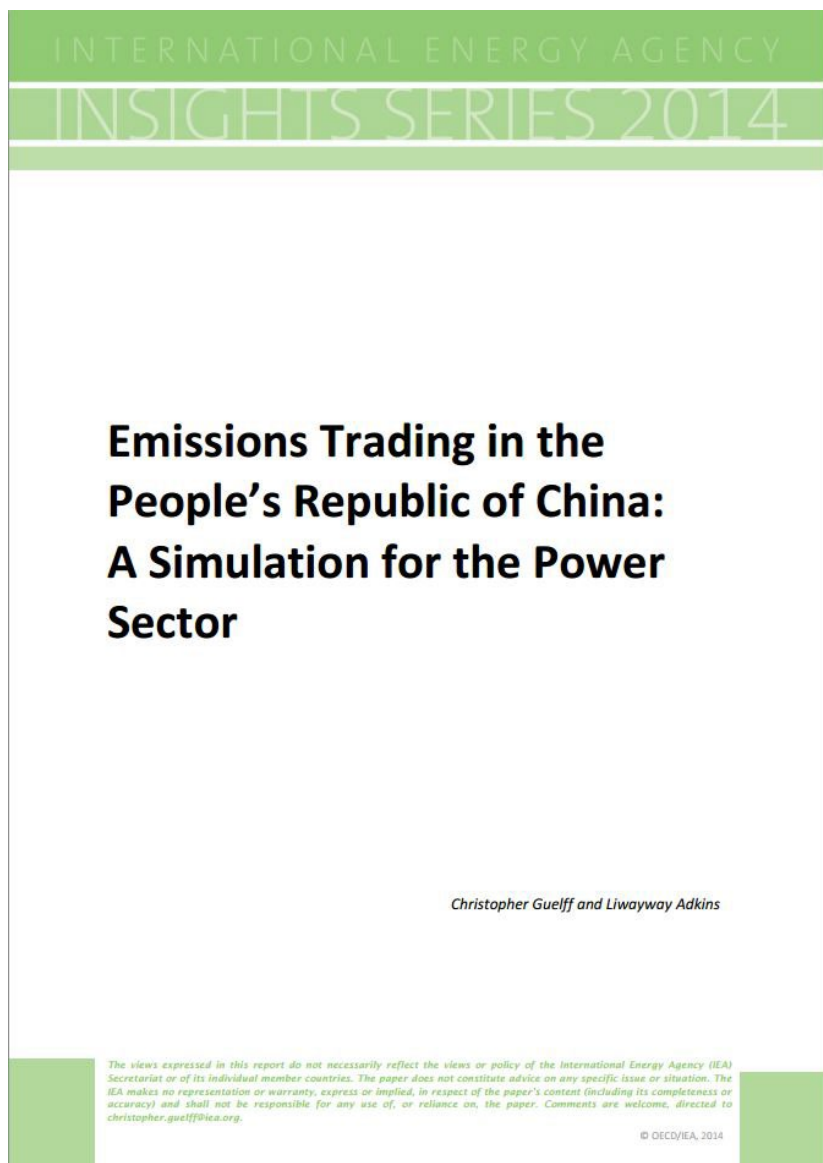
- Market Instruments (notably, carbon pricing)
- SPC Targeted Interventions:
  - Direct: exercising shareholder power
  - Indirect: government support for public sector entities

# Influencing SPCs: Carbon pricing approaches

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- Carbon taxes
- ETS: can be effective sector-wide instrument for multiple SPC actors, but more cap than trade
- Shadow pricing for SPC decision-making

# ETS with Power SPCs: China simulation



**SPCs responded and complied: simulated ETS worked (to some extent)**

**Special challenges:**

- **Why sell allowances**  
*-- so tweaked incentives*
- **Hesitate to pay competitor**

**Caps more than trade**

# Targeted Direct – Shareholder Power

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- Formal directives through Board resolutions and instructions
- CEO/Senior management appointments/dismissals
- Informal discussions with senior management
- Changes to subsidy/budgetary support from government
- Mandating/prompting operational changes:
  - shadow carbon pricing
  - portfolio standards/carbon intensity requirements
  - improvement of carbon accounting and climate risk management standards
- Capacity training/enhancement

# Targeted Indirect – Gov. support to SPCs

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- Associated infrastructure (e.g., transmission line to RE site)
- Preferential financing/lending terms
- Coordinated R&D
- Expedited administrative actions: permitting, imports, etc.
- Price adjustments upstream or downstream of SPC
- Support new SOE market entrants



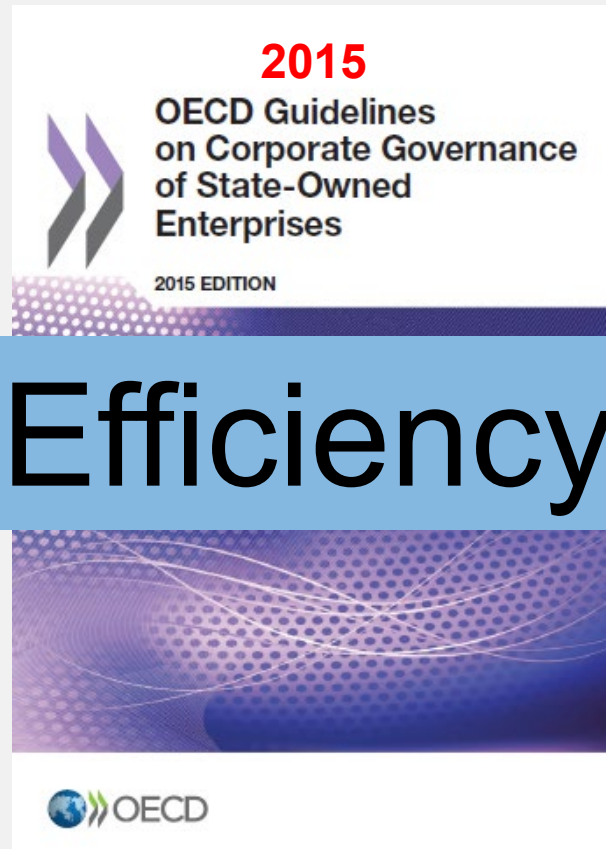
# **A powerful suite of tools: “All of the above”**

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- Targeted direct (direction, leadership, TA)
- Targeted indirect (financing, associated infra)
- Market-wide instruments
- Sector-wide law

# SOEs: Change in approach?

- ▶ **“Controversial” economic actors?**
- ▶ **“SOE reform”**



## VII. State-owned enterprises and sustainability 2022

(NEW CHAPTER)

# Climate Effectiveness

- consistent with the ownership policy and practices. In doing so, the state should respect the rights and fair treatment of all shareholders;
2. Communicating and clarifying shareholders' expectations on sustainability through regular dialogue with the boards, with due consideration for stakeholder interests;
  3. Assessing, monitoring and reporting on sustainability objectives and performance of SOEs on a regular basis.
- B. The state should expect SOE boards to adequately consider sustainability risks and opportunities when fulfilling their key functions. The following prerequisites are essential for ensuring effective sustainability management at enterprise level:
1. SOE boards should develop, implement and disclose sustainability-related strategies, objectives and targets based on verifiable metrics, and in line with shareholders' expectations, applicable legal and regulatory requirements;
  2. SOEs should integrate sustainability considerations into their risk management and internal control systems;
  3. SOE boards should effectively assess and monitor management performance, including on sustainability. Where SOE boards introduce specific remuneration schemes, such incentives should be carefully balanced and linked to relevant and material risks and the company's

# SPCs – effective vehicles for decarbonization?

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- Can potentially be effective where:
  - Dominant
  - Resourced
  - Operational and financial capacity
  - Policy alignment/commitment at political and corporate levels
- Potentially more volatile: direct susceptibility to changing government preferences



**Not all SPCs are created  
the same**

# Not all SPCs are created the same

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## Decarbonization in state-owned power companies: Lessons from a comparative analysis

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### ABSTRACT

A rapid decarbonization of the electricity system is urgently required for the Paris Agreement objectives to stand a reasonable chance of being met. While state-owned power companies (SPCs) are the dominant firm type in the global electricity sector, representing nearly two thirds of global electric power generation capacity, most climate policy literature focuses on private sector companies when analyzing decarbonization interventions. SPCs' distinct corporate governance structures, objectives, relationships with government, and sources of finances, however, can be markedly different from those of private companies. Here, we develop a framework for analyzing the extent to which common and divergent features of SPCs, and the markets in which they operate, affect their relationship to government interventions on decarbonization. We also consider the implications of these relationships for the effective implementation of sector-wide decarbonization strategies. We then apply this framework using a comparative case study analysis of six major SPCs, and highlight how differences in their agency, motivation, capacity, and market exposure may result in different potential responsiveness to government regulatory, policy and market interventions on decarbonization. We generalize these findings by developing four SPC archetypes and illustrate how they might respond differently to government interventions targeting decarbonization. Our analysis posits that SPCs can, under the guidance of governments pursuing ambitious climate policy, be more effective vehicles for decarbonization relative to private sector companies, particularly when they operate with a high degree of operational independence, are insulated from competitive pressures, and have the financial and technical capacity to invest in the decarbonization of their asset base. Similarly, market-wide policy interventions, such as carbon pricing mechanisms, could in practice be less effective interventions with respect to SPCs than their private counterparts when the SPC is ill-equipped to translate these incentives into decarbonization action because it is mandated to pursue supplementary objectives other than profit maximization alone. Ultimately, governments will need to step up their climate action to achieve carbon neutrality. SPCs can, and where they are major market players, must be key actors in driving decarbonization when the appropriate interventions are utilized and therefore deserve significantly more attention in the climate policy debate.

## 1. Introduction

### 1.1. The power sector and the Paris Agreement

Power generation makes the largest sectoral contribution to greenhouse gas emissions. Electricity and heat generation produced nearly 15.2 billion tons of carbon dioxide-equivalent (GtCO<sub>2</sub>e) in 2017, 32.5%

of the global total (ClimateWatch, 2020). Growing numbers of national governments have either announced or legislated for economy-wide 'net zero emissions', including China (peaking before 2030, neutrality by 2060), Japan, the United States, South Africa, Brazil, Canada, South Korea, New Zealand, Chile, and the European Union (all 2050) (Energy & Climate Intelligence Unit, 2021). The International Energy Agency (2021) cautions that economy-wide decarbonization by 2050 will, on aggregate, require advanced economies to decarbonize electricity by

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E-mail address: [alex.clark@smithschool.ox.ac.uk](mailto:alex.clark@smithschool.ox.ac.uk) (A. Clark).

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## Decarbonising state-owned power companies: A framework for applying policy actions

Moritz Schwarz, Philippe Benoit, Alex Clark

Oxford Smith School of Enterprise and the Environment | Working Paper No. 23-01

ISSN 2732-4214 (Online)



# Not all SPCs are created the same

Company	Country	World Bank income group (2021)	Electricity market concentration index (HHI) [1-100]	Government equity ownership	% National Generation	Installed Capacity (GW)
NTPC	India	Lower middle income	6	51%	25%	65.8
KEPCO	Korea	High income	60	51.1%	92%	83.7
SPIC	China	Upper middle income	8	100%	5%	165.0
PLN	Indonesia	Lower middle income	50	100%	66%	41.7
CFE	Mexico	Upper middle income	52	100%	79%	56.2
Eskom	South Africa	Upper middle income	87	100%	85%	44.2

# Not all SPCs are created the same

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## Agency of the SPC

Level of control by the government,  
autonomy of the executive staff

## Profit Motivation

Vs. focus on non-financial goals  
(affordable, secure energy supply,  
development, etc.)

## Capacity to Act

Financial situation, dependence on  
budgetary transfers, technical  
competency

## Exposure to Market Forces

Competition through other SPCs or  
private enterprises as well as IPPs.

# Not all SPCs are created the same

	Agency	Profit Motivation	Fin/Tech Capacity	Exposure to Competition
NTPC	M/H	M/H	M/H	H
KEPCO	M	M/H	H	L
SPIC	M	M/H	H	M
PLN	M/L	M/L	M	M/L
CFE	L	M	M/H	M/L
Eskom	L	M/L	M/L	L
Private	H	H	H	M/H





# Matching Policies to SPC specificities

# Mapping climate tools to SPC attributes

<i>Selected Climate Intervention</i>	<i>High Agency</i>	<i>High Profit Motivation</i>	<i>High Capacity</i>	<i>Exposure to Competition</i>
<i>Targeted Direct Actions – Shareholder Prerogatives</i>	Red	Yellow	Green	Red
<i>Targeted Indirect Actions – Government Resources Deployment</i>	Yellow	Green	Green	Green
<i>Market instruments</i>	Yellow	Green	Yellow	Green

# Mapping climate tools to SPCs: illustration

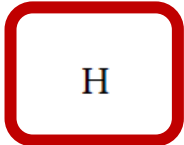
	Agency	Profit Motivation	Capacity	Exposure to Competition	Targeted Direct - Shareholder Prerogatives	Targeted Indirect - Gov Resource Deployment	Market Wide Instruments
<b>NTPC</b>	M/H	M/H	M/H	H	M	H	M/H
<b>KEPCO</b>	M	M/H	H	L	M	H	M
<b>SPIC</b>	M	M/H	H	M	H	H	M
<b>PLN</b>	M/L	M/L	M	M/L	H	M	L
<b>CFE</b>	L	M	M/H	M/L	H	H	L
<b>Eskom</b>	L	M/L	M/L	L	H	M	L
<b>Private</b>	H	H	H	M/H	L	M/H	H

# Mapping climate tools to SPCs: illustration

	Agency	Profit Motivation	Capacity	Exposure to Competition	Targeted Direct - Shareholder Prerogatives	Targeted Indirect – Gov Resource Deployment	Market Wide Instruments
NTPC	M/H	M/H	M/H	H	M	H	M/H
KEPCO	M	M/H	H	L	M	H	M
SPIC	M	M/H	H	M	H	H	M
PLN	M/L	M/L	M	M/L	H	M	L
CFE	L	M	M/H	M/L	H	H	L
Eskom	L	M/L	M/L	L	H	M	L
Private	H	H	H	M/H	L	M/H	H

# SPCs: 4 Archetypes

# SPCs: Potential of SPC archetypes to advance decarbonization

Company Archetype	Potential Impact	Comment
<b>Competitive Contributor</b>	M/H	High capacity and generally profit-seeking motivation allow it to be effective and efficient in implementing decarbonization actions when it chooses, but its limited role in the market limit its influence on sectoral decarbonization. Government can take direct action to influence its behavior, although it may encounter resistance from the SPC in attempting to do so and the result may not be either effective or efficient.
<b>Grinding Behemoth</b>		Dominant position in the electricity market and status as near-sole, or sole, purchaser of electricity gives it potential to contribute substantially to sectoral decarbonization, but inefficiencies, motivations beyond profit-seeking, and capacity/resource constraints, can limit this potential. Government can take direct action to alter its motivations or mobilize resources in support of the SPC to allow potential to be fulfilled.

# SPCs: Potential of SPC archetypes to advance decarbonization

Company Archetype	Potential Impact	Comment
<b>Statist Caterer</b>	M	Dominant position in electricity market gives it potential to contribute substantially to sectoral decarbonization, but limited agency and subservience to government means ability to do so depends on SPC's internalization of government priorities and ability to act on them. Limited capacity to address operational inefficiencies, given its primary purpose as service provider and/or development actor, will likely increase the cost of decarbonization relative to Competitive Contributors.
<b>Depleted Provider</b>	L	Dominant position in electricity market gives it potential to contribute substantially to sectoral decarbonization, but potential remains largely unfulfilled due to chronic financial and operational challenges preventing realization of corporate strategy. With direct, indirect and market-wide actions unlikely to succeed, government should consider firm restructuring or unbundling, and/or market reforms to encourage entry by other players.

# SPCs: Potential of SPC archetypes to advance decarbonization

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Company Archetype	Potential Impact	Comment
<b>Private Sector</b>	M/H	High capacity and profit-seeking motivation allow it to be effective and efficient in implementing decarbonization actions when it chooses to do so, but its limited role in the market limit its influence on sectoral decarbonization to its impact on other private firms' behavior. This is particularly relevant to economies featuring vertically integrated SPCs. It is more difficult for government to influence its behavior through non-market wide mechanisms.



# SPCs: a typology

	Key factors				Potential impact of interventions		
SPC Archetype	Agency	Profit Motivation	Capacity	Exposure to Competition	Targeted direct	Targeted indirect	Market-wide
Private Sector	H	H	H	H	N/A	M*	H
Competitive Player	M/H	M/H	H	M/H	M	H	M/H
Grinding Behemoth	M	M	M/H	M/L	H	M	M/L
Statist Caterer	L	M/L	M	L	H	H	L
Depleted Provider	L	M/L	L	L	H	M	L



# Stranded Assets Analysis for Government owners

# Stranded Assets for Government Owners



CLIMATE POLICY  
<https://doi.org/10.1080/14693062.2022.2062285>

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RESEARCH ARTICLE

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## Government shareholders, wasted resources and climate ambitions: why is China still building new coal-fired power plants?

Alex Clark<sup>a</sup>, Philippe Benoit<sup>b</sup> and Jonathan Walters<sup>c</sup>

<sup>a</sup>Smith School of Enterprise and the Environment and Institute for New Economic Thinking, University of Oxford, Oxford, UK; <sup>b</sup>Center on Global Energy Policy, Columbia University, New York, NY, USA; <sup>c</sup>Oxford Institute for Energy Studies, Oxford, UK

### ABSTRACT

Despite its carbon neutrality commitments and the prospect of increasingly stringent climate policy measures, China is continuing to build new coal-fired power plants. In assessing the expected performance of these investments, it is helpful to analyse them through an 'economic' framework measuring a broader view of the country-level economic returns on new coal power investments, as a complement to the plant-level financial analysis framework commonly used to assess stranded asset risks. This simplified economic framework, in which inputs and outputs are measured according to the costs and benefits they generate for the national economy, leads to markedly different dynamics than financial analysis alone. This framework can help China to avoid 'wasting' scarce public resources by over-investing in new uneconomic power plants through its state-owned enterprises. Applying this approach to a representative new coal plant in China shows that modest shadow carbon pricing (rising from US\$15/tCO<sub>2</sub> in 2026, to US\$30/tCO<sub>2</sub> in 2041) eliminates the expected value of the project to China's economy. Caps on coal-fired electricity generation have less impact on economic returns, but severely undermine financial returns, potentially making such caps a more effective short-term policy tool to dissuade company executives from making new coal investments. Without carbon pricing, only a moratorium on coal-fired power generation in 2030 or earlier prevents new plants from realizing a positive economic return. Comparing these results with an alternative solar/storage investment suggests the renewable option generates higher economic returns than the coal plant under modest shadow carbon pricing and lower electricity storage costs.

### ARTICLE HISTORY





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### KEYWORDS

China; coal power; economic analysis; financial analysis; renewable energy; stranded assets

### Key policy insights:

- Economic analysis of proposed coal plants complements plant-level financial analysis and better captures governments' interests in these projects. Both economic and financial analyses are relevant to the decision-making of government shareholders.
- State-led coal plant investments in China today is likely to be economically wasteful under modest future climate policy scenarios, particularly in light of declining levelized costs of renewable alternatives.
- This framework for combined financial and economic analysis also applies to other countries' proposed investments in carbon-intensive power generation. The framework is particularly pertinent for countries with state-led coal power investments planned, including India, Indonesia, Pakistan, South Africa, and Vietnam.

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# Analysis by International Climate Experts Questions Coal's Profitability



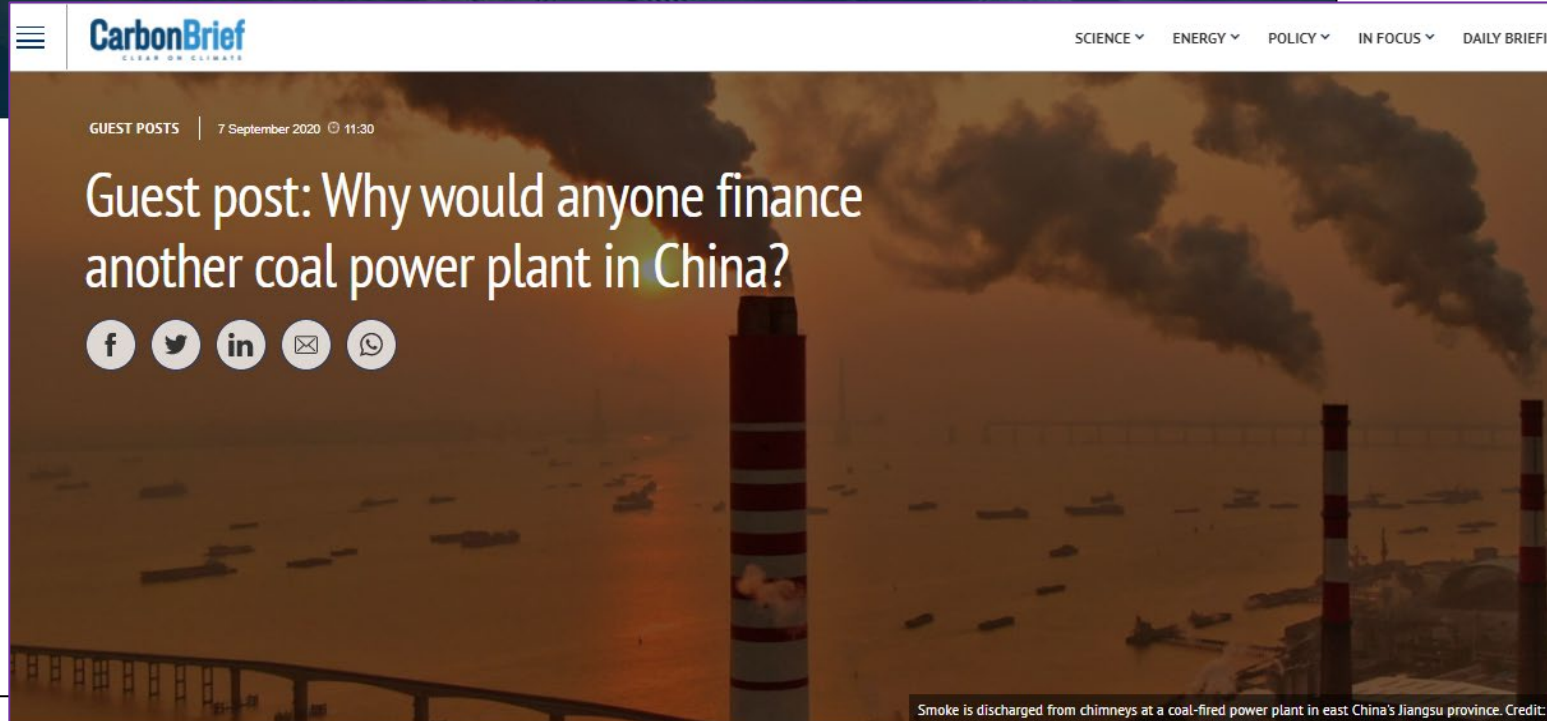
Carbon Tracker Initiative

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Home / News & Events / Press Releases / 40% of China's coal power stations are losing money

Press Releases

## 40% of China's coal power stations are losing money



CarbonBrief CLEAR ON CLIMATE

SCIENCE ▾ ENERGY ▾ POLICY ▾ IN FOCUS ▾ DAILY BRIEF

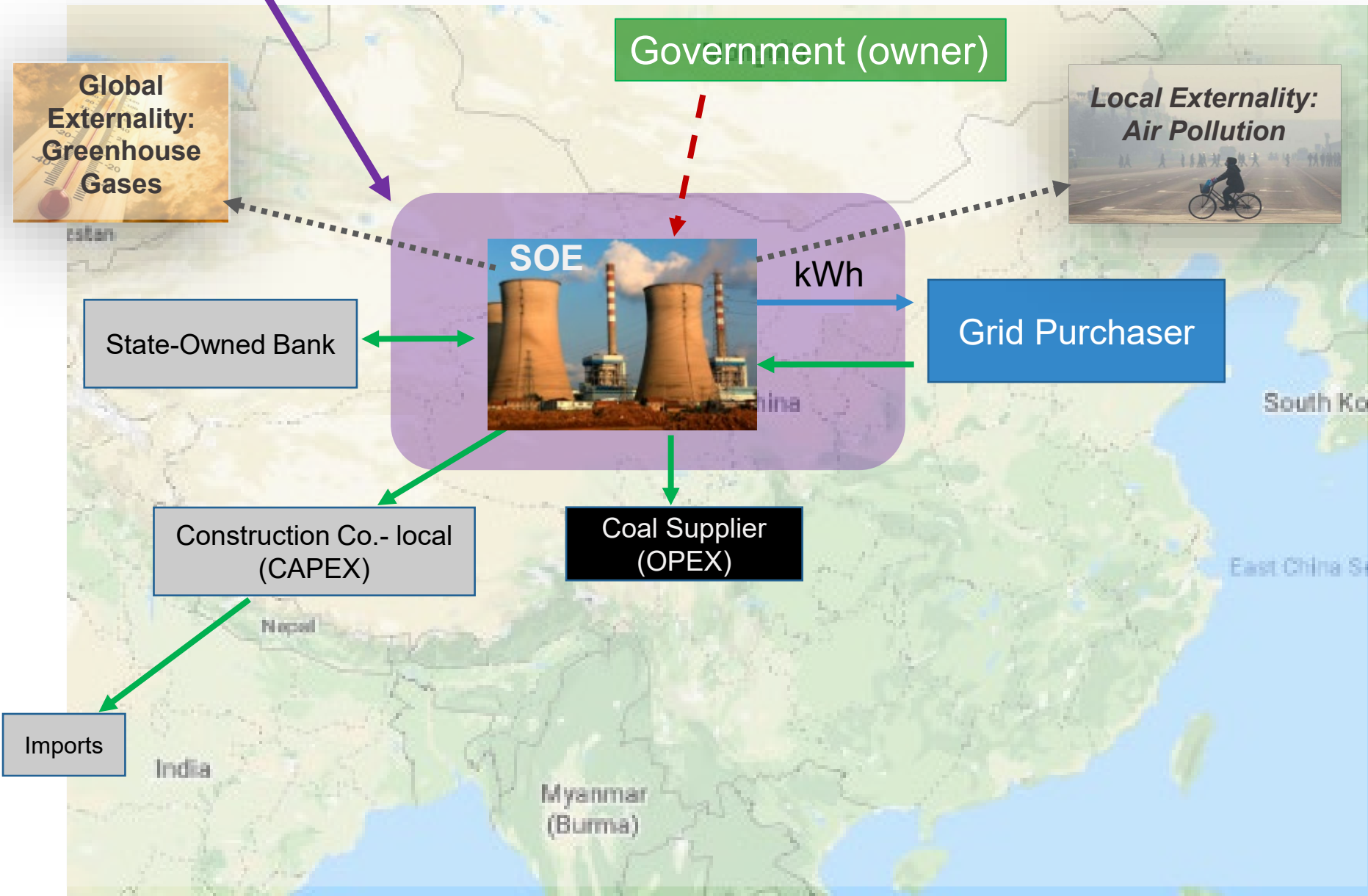
GUEST POSTS | 7 September 2020 | 11:30

## Guest post: Why would anyone finance another coal power plant in China?

f t in ✉

Smoke is discharged from chimneys at a coal-fired power plant in east China's Jiangsu province. Credit:

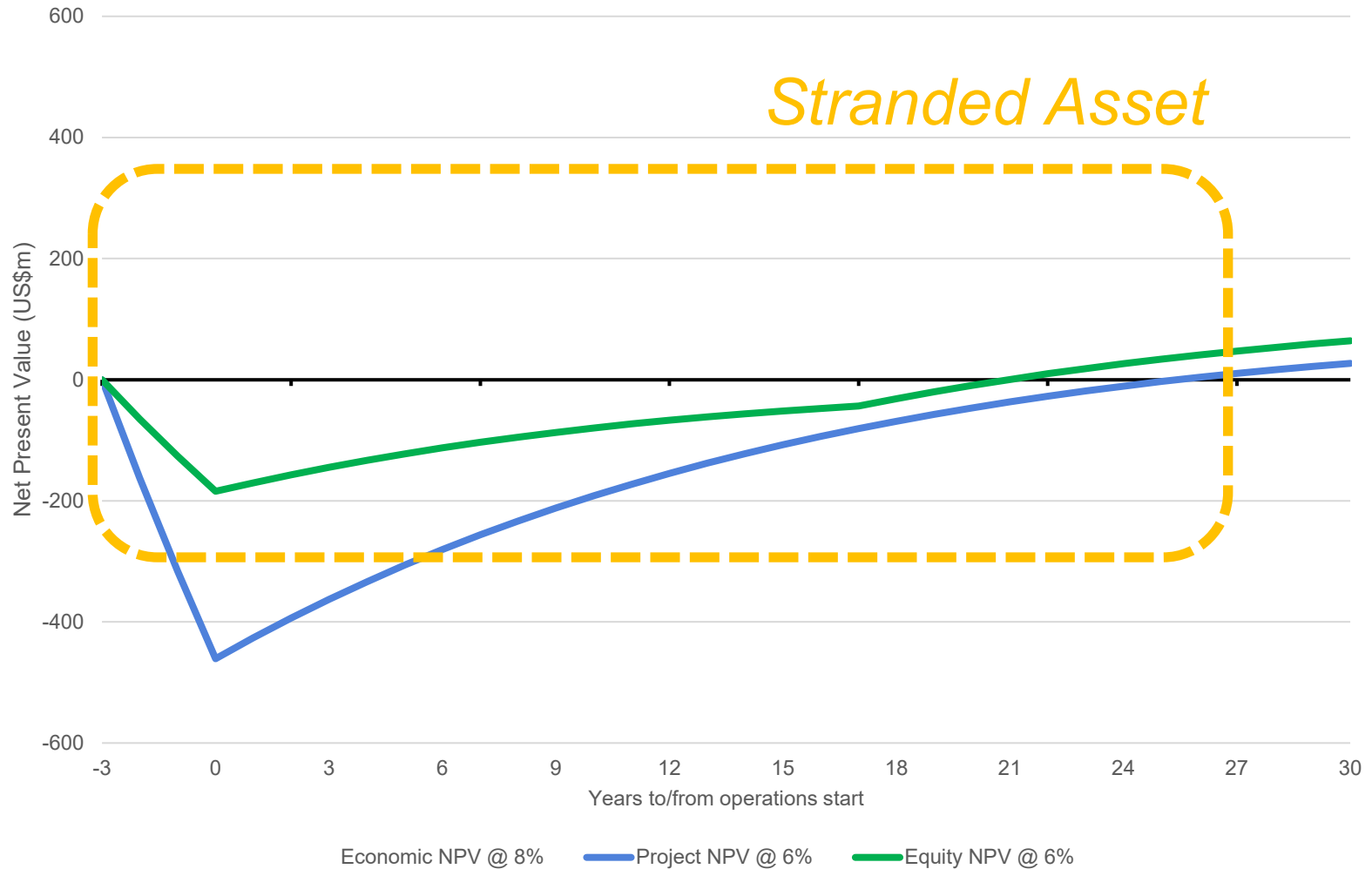
# Financial (plant-level) analysis of a power plant



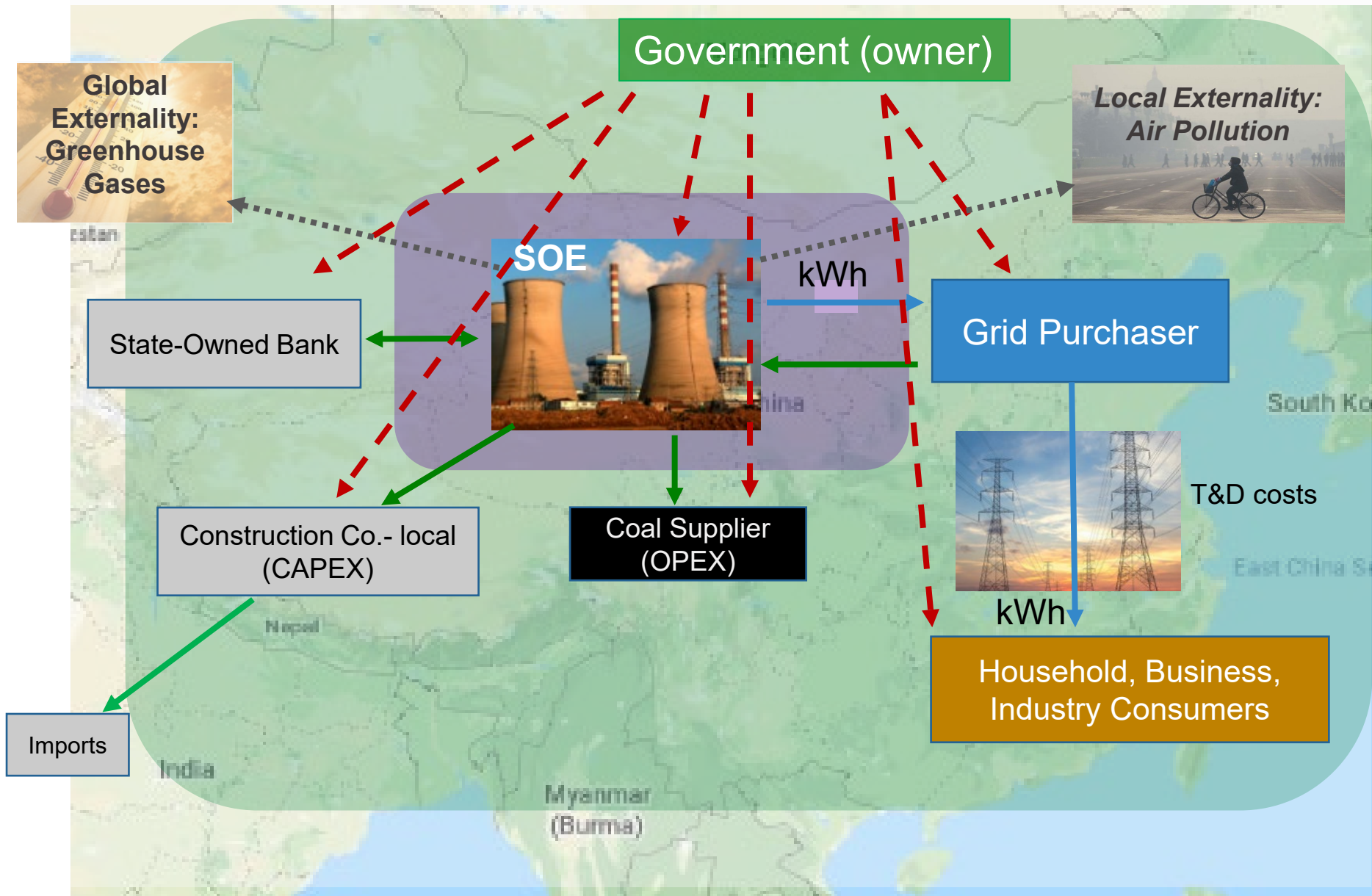
# Financial analysis: inputs and assumptions

Component	Unit	Financial Analysis (nominal)
<b>Physical Characteristics</b>		
Capacity	MW	1,000
Coal energy content	MWh/ton	18.84
<b>Plant efficiency</b>	%	<b>48%</b>
<b>Construction</b>		
<b>Construction period</b>	years	<b>3</b>
<b>Capital cost</b>	US\$ / MW	<b>517,366</b>
<b>Financing</b>		
Inflation rate costs - Tariff Index	%/year	2.1% for costs; 1.5% PPA tariff
<b>Debt/Equity Ratio</b>	%	<b>60/40</b>
Domestic financing	% of financing	100%
<b>Loan tenor</b>	years	<b>20</b>
<b>Operations</b>		
Operating life	years	30
<b>Load factor</b>	%	<b>48%</b>
Initial coal fuel cost	US\$ / ton of fuel delivered	76.52
Initial operating costs	US\$ / MW-year	11,549
<b>Revenues/Benefits</b>		
<b>Electricity price received</b>	US\$/ MWh	<b>47.12</b>

# SPC vs. Gov. Returns ... and Stranded Assets



# Financial vs country-level “economic” analysis of a power plant

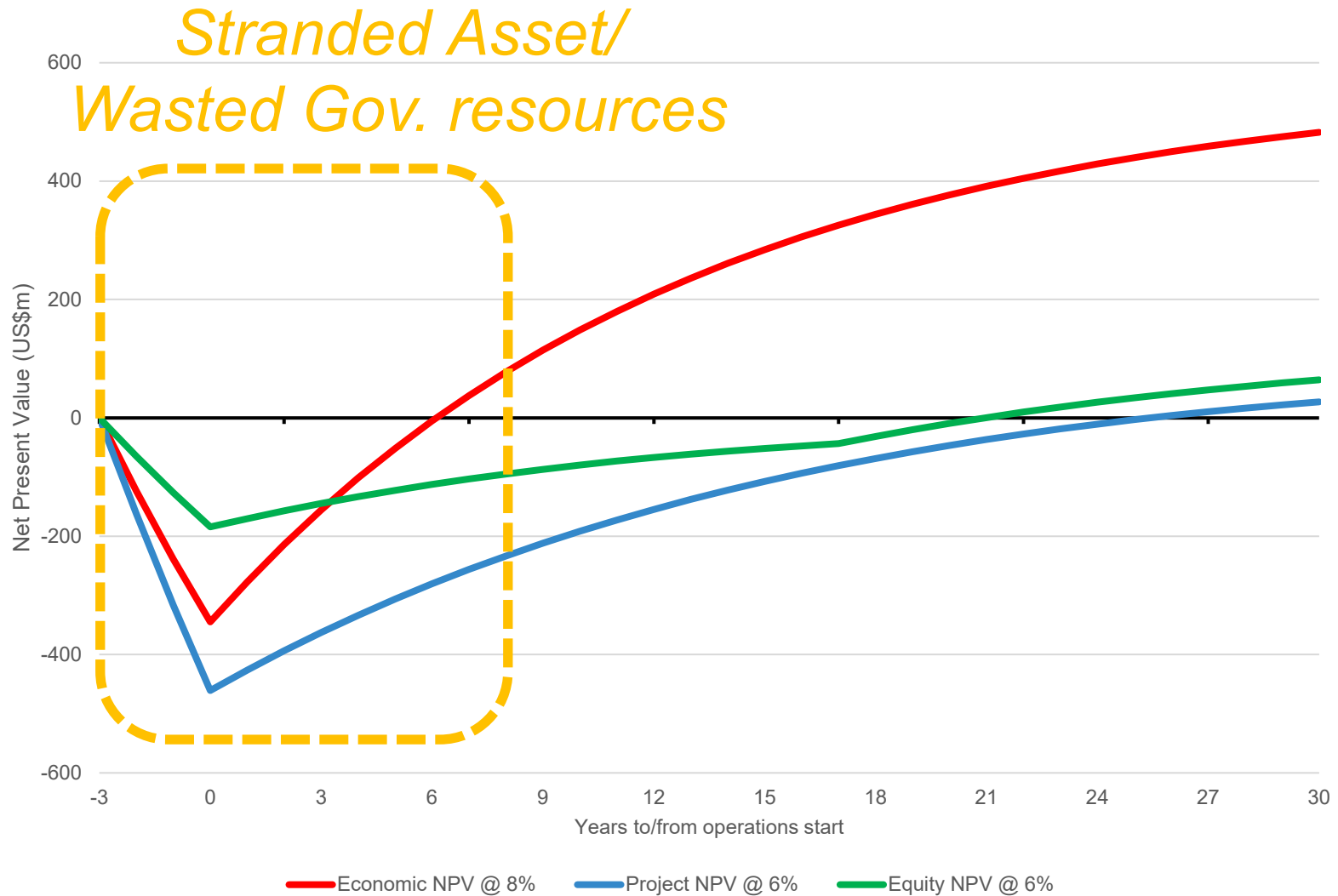




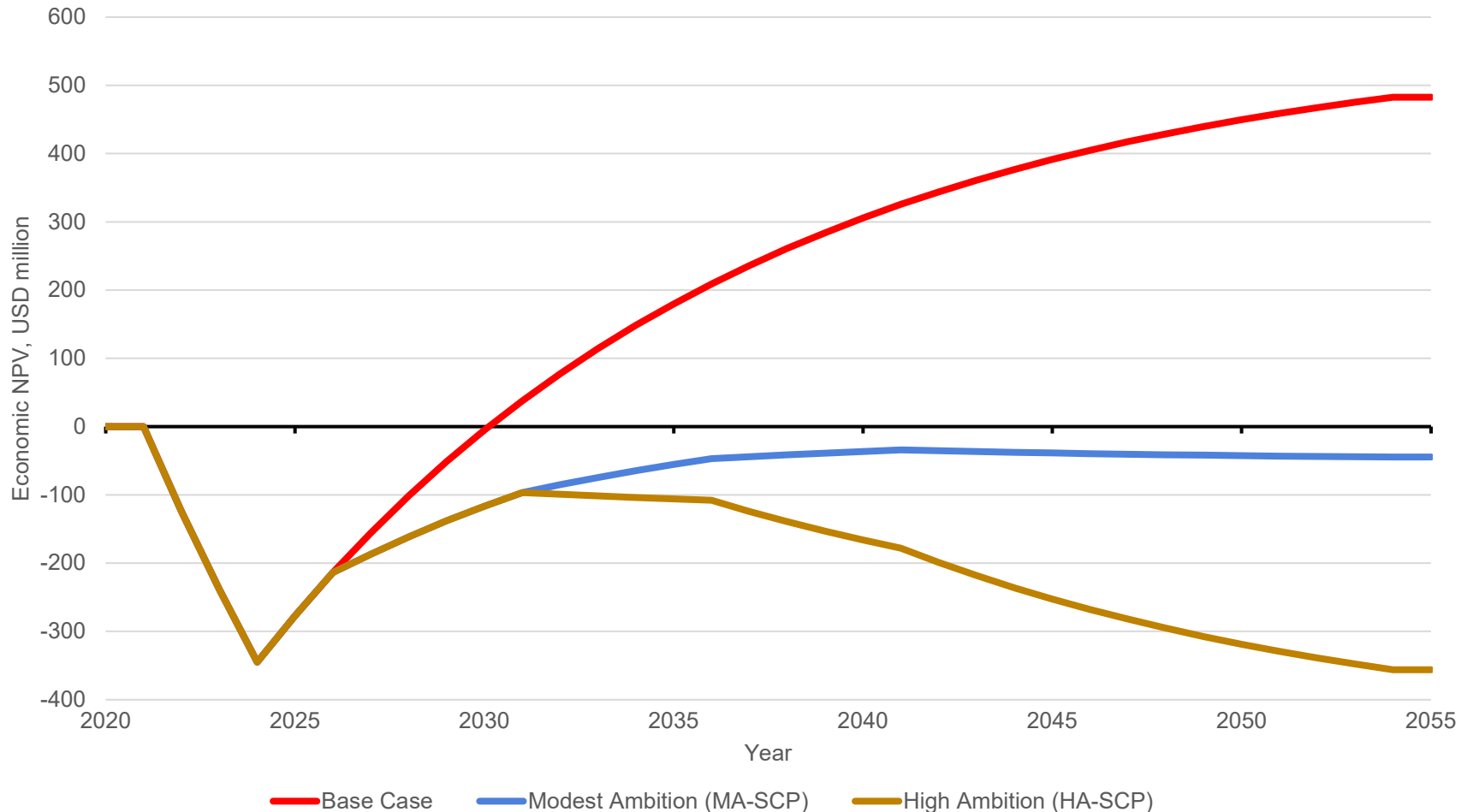
# Adding “Economic” Analysis: Inputs, assumptions

Component	Unit	Financial Analysis (nominal)	Economic Analysis (real)
<b>Physical Characteristics</b>			
Capacity	MW	1,000	
Coal energy content	MWh/ton	18.84	
Plant efficiency	%	48%	
<b>Construction</b>			
Construction period	years	3	
<b>Capital cost</b>	US\$ / MW	517,366	<b>401,657</b>
<b>Financing</b>			
Inflation rate costs - Tariff Index	%/year	2.1% for costs; 1.5% PPA tariff	-
Financial discount rate	%/year	6%	-
<b>Economic discount rate</b>	%/year	-	<b>8%</b>
Domestic financing	% of financing	100%	
Loan tenor	years	20	<b>N/A</b>
Interest payments		4.35%	<b>N/A</b>
<b>Operations</b>			
Operating life	years	30	
Load factor	%	48%	
Initial coal fuel cost	US\$/ton delivered	76.52	<b>72.57</b>
Initial operating costs	US\$ / MW-year	11,549	<b>9,816</b>
<b>Weighted average T&amp;D costs</b>	US\$ / MWh	-	<b>30.0</b>
<b>Revenues/Benefits</b>			
Electricity price received	US\$ / MWh	47.12	-
% industrial users	%	-	<b>62%</b>
<b>Weighted average willingness to pay</b>	US\$ / MWh	-	<b>87.9</b>

# SPC vs. Gov. Returns ... and Stranded Assets



# Shadow carbon price destroys econ. value



Economic NPV (8% discount rate)

Base Case: no shadow carbon price.

Modest Ambition: \$15/tCO<sub>2</sub> in 2026, increasing by \$5 every 5 years to \$30 in 2041

Higher Ambition: \$15/tCO<sub>2</sub> in 2026, increasing by \$15 every 5 years to \$60 in 2041

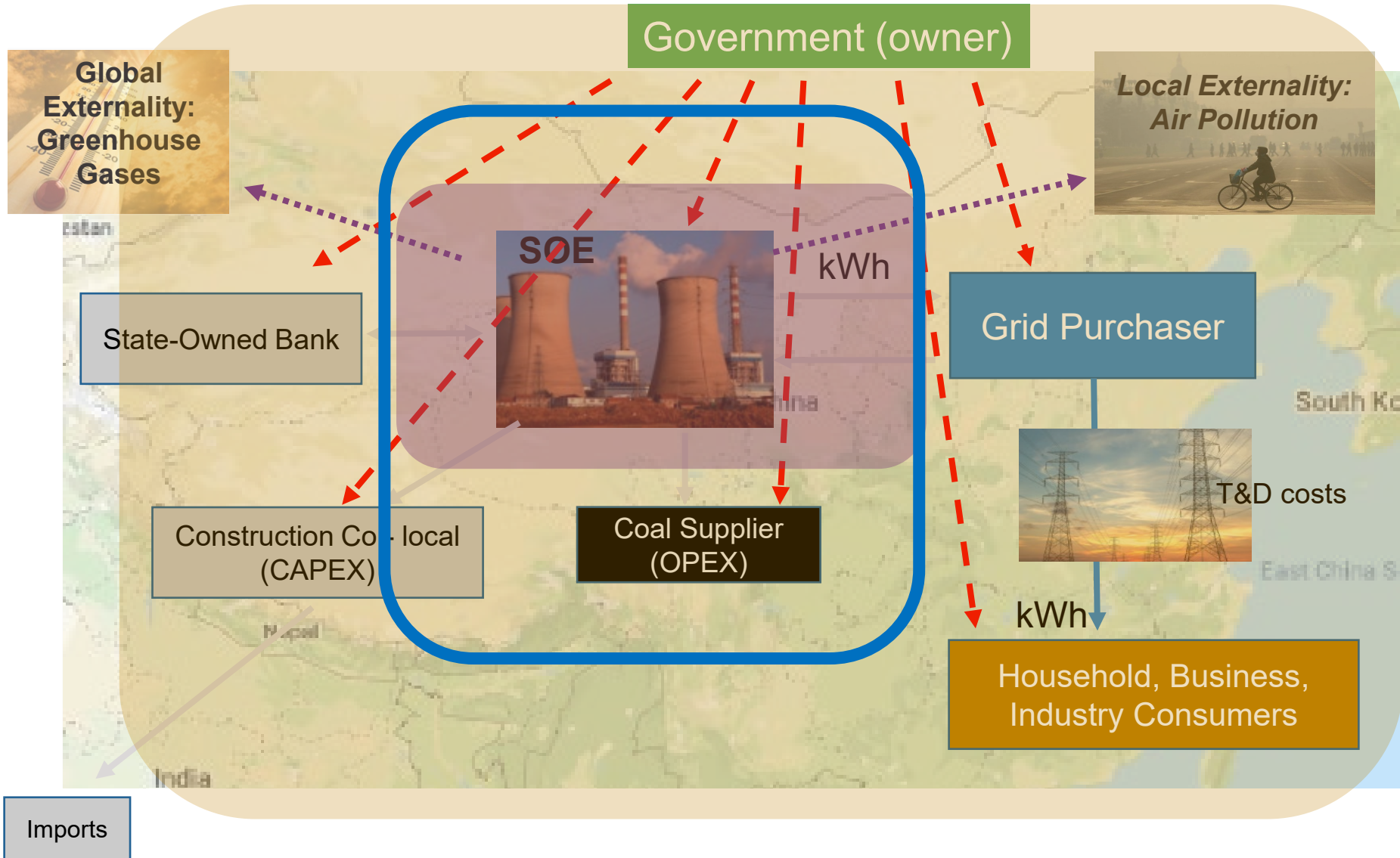
**ENPV under Modest Ambition = -\$50 million**



# Adjusted LCOE?

(LECOE: Levelized “economic” cost of electricity)

# LCOE: Gov. “intra-corporate” transfers



# LCOE:

## 1. IEA base case (but with no carbon price)

**All generation** ▼ **By country** ▼ **China** ▼

Discount rate: 7% Central case

Carbon price: 0.00 USD/ton 30.00 USD lower than default

Heat price: 0.00 USD/MWh 37.06 USD lower than default

Coal price: 100% Default assumption

Gas price: 100% Default assumption

Table  Chart

[Reset assumptions](#) [Download data](#)

Category	Plant type	Capital costs	O&M	Fuel (th)	Fuel (el)	Carbon	CHP heat revenues	↑ LCOE
USD/MWh								
Solar	Solar PV (utility scale) (20.0 MW)	<b>42.76</b>	8.02	0.00	0.00	0.00	0.00	<b>50.78</b>
Coal	Ultra-supercritical (347 MW)	<b>8.97</b>	14.97	12.61	28.02	0.00	0.00	<b>51.96</b>
Wind	Wind onshore (>= 1 MW) (50.0 MW)	<b>45.25</b>	13.18	0.00	0.00	0.00	0.00	<b>58.43</b>
Nuclear	Nuclear (950 MW)	<b>29.60</b>	26.42	0.00	10.00	0.00	0.00	<b>66.01</b>
Gas	Gas (CCGT) (475 MW)	<b>6.53</b>	13.49	31.05	53.53	0.00	0.00	<b>73.56</b>

# LECOE: Gov coal supplier to SPC

## 2. IEA base case but with “ownership discount” for coal:

All generation ▼ By country ▼ China ▼

Discount rate: 7%  
Central case

Carbon price: 0.00 USD/ton  
30.00 USD lower than default

Heat price: 0.00 USD/MWh  
37.06 USD lower than default

**Coal price: 80%**  
20% lower than default

Gas price: 100%  
Default assumption

Table  Chart

[Reset assumptions](#) [Download data](#)

Category	Plant type	Capital costs	O&M	Fuel (th)	Fuel (el)	Carbon	CHP heat revenues	↑ LCOE
USD/MWh								
Coal	Ultra-supercritical (347 MW)	8.97	14.97	10.09	22.42	0.00	0.00	46.36
Solar	Solar PV (utility scale) (20.0 MW)	42.76	8.02	0.00	0.00	0.00	0.00	50.78
Wind	Wind onshore (>= 1 MW) (50.0 MW)	45.25	13.18	0.00	0.00	0.00	0.00	58.43
Nuclear	Nuclear (950 MW)	29.60	26.42	0.00	10.00	0.00	0.00	66.01
Gas	Gas (CCGT) (475 MW)	6.53	13.49	31.05	53.53	0.00	0.00	73.56

# LECOE: Gov debt provider to SPC

## 3. Applying a lower discount rate given funding from State-owned banks to the low-coal cost case

All generation ▼ By country ▼ China ▼

**Discount rate**  
5%  
2% below central case

**Carbon price**  
0.00 USD/ton  
30.00 USD lower than default

**Heat price**  
0.00 USD/MWh  
37.06 USD lower than default

**Coal price**  
80%  
20% lower than default

**Gas price**  
100%  
Default assumption

Table  Chart

[Reset assumptions](#) [Download data](#)

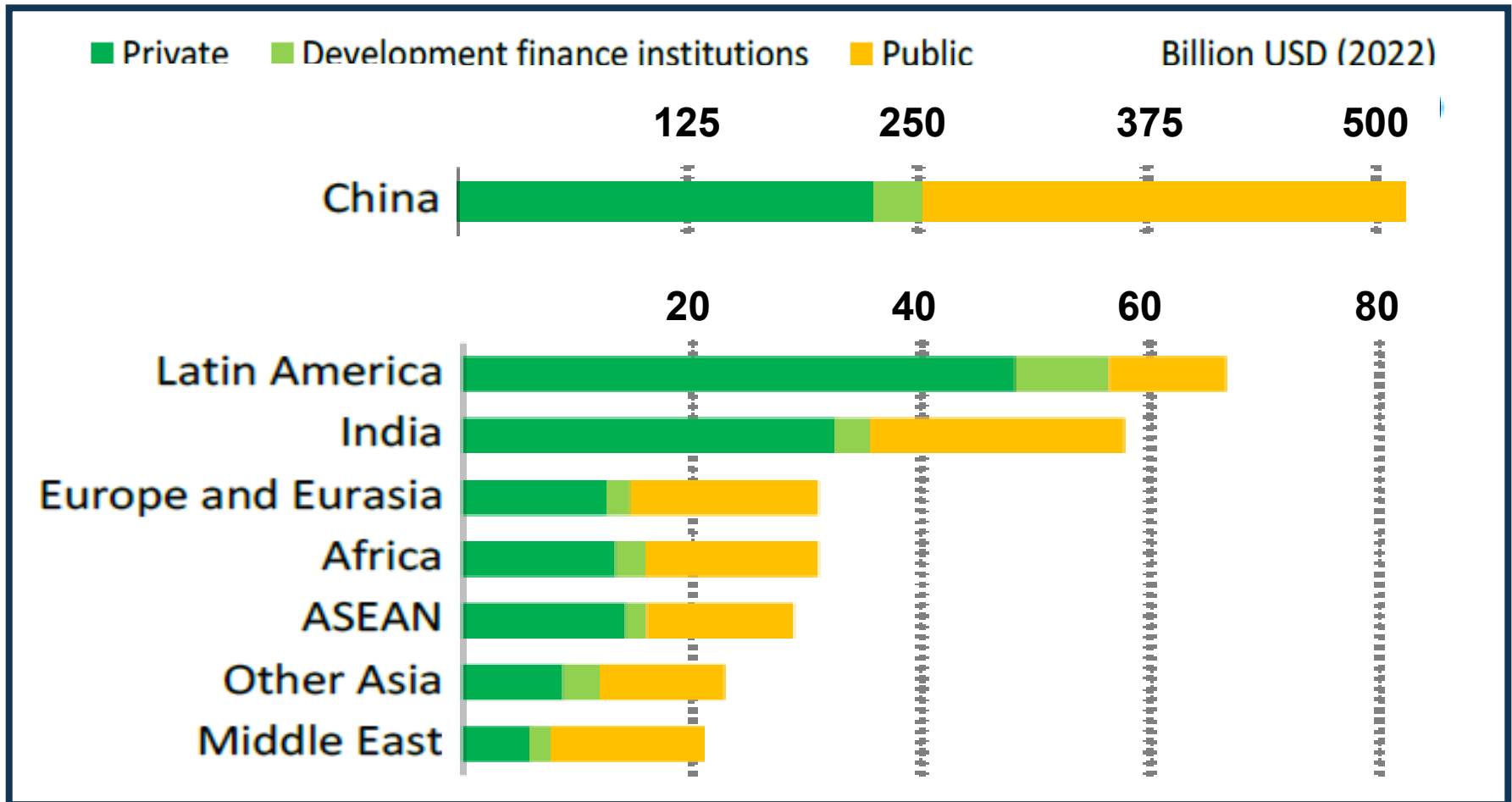
Category	Plant type	Capital costs	O&M	Fuel (th)	Fuel (el)	Carbon	CHP heat revenues	↑ LCOE
USD/MWh								
Solar	Solar PV (utility scale) (20.0 MW)	35.70	8.02	0.00	0.00	0.00	0.00	43.72
Coal	Ultra-supercritical (347 MW)	6.79	14.97	10.09	22.42	0.00	0.00	44.18
Wind	Wind onshore (>= 1 MW) (50.0 MW)	37.61	13.18	0.00	0.00	0.00	0.00	50.79
Nuclear	Nuclear (950 MW)	20.72	26.42	0.00	10.00	0.00	0.00	57.13





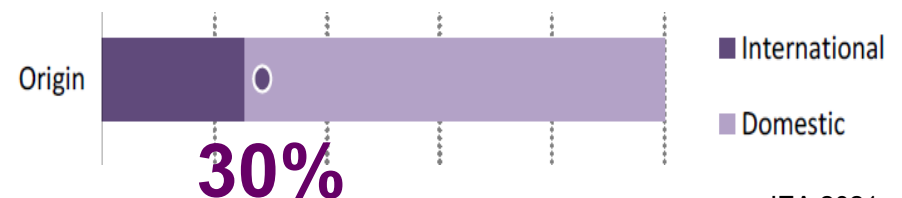
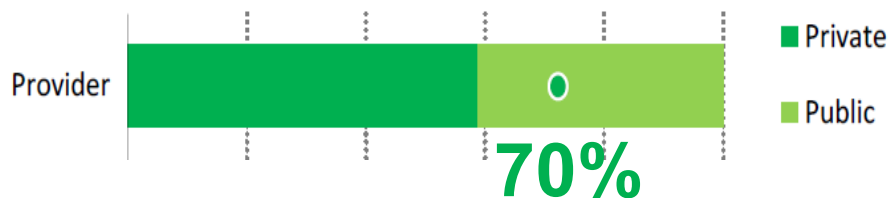
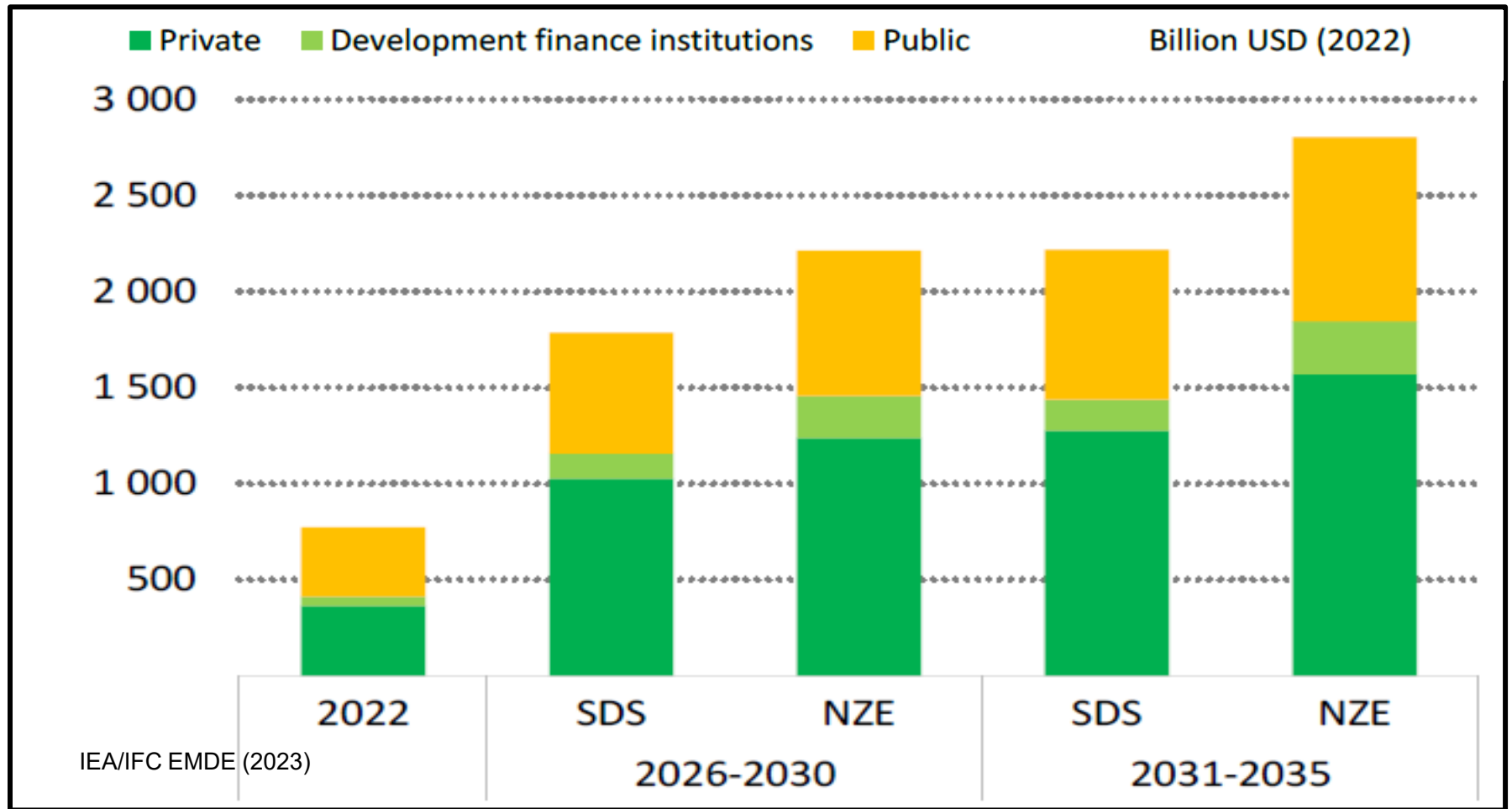
# SOE/public sector funding of clean energy

# Source of financing for clean: today



**In EMDEs: about 50% public entity sources (IEA: “largely by SOEs”)**  
**In Advanced Economies: <20% public entities**

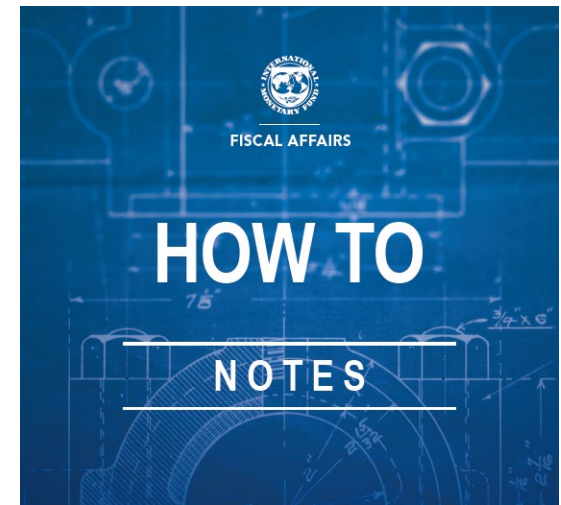
# Source of financing for clean: tomorrow?



# To whom: SPCs and Private Capital

**SPCs have over \$850 in outstanding bonds and market loans:**

- KEPCO: \$91 billion
- EDF: \$88 billion
- PLN: \$30 billion
- Eskom: \$26 billion
- NTPC: \$18 billion
- CFE: \$18 billion
- EGAT: \$2.6 billion
- SPIC: \$51 billion
- TEPCO (Jn): \$42 billion
- TVA (US): \$19 billion



How to Assess Fiscal Risks from  
State-Owned Enterprises  
Benchmarking and Stress Testing

NOTE 21/09

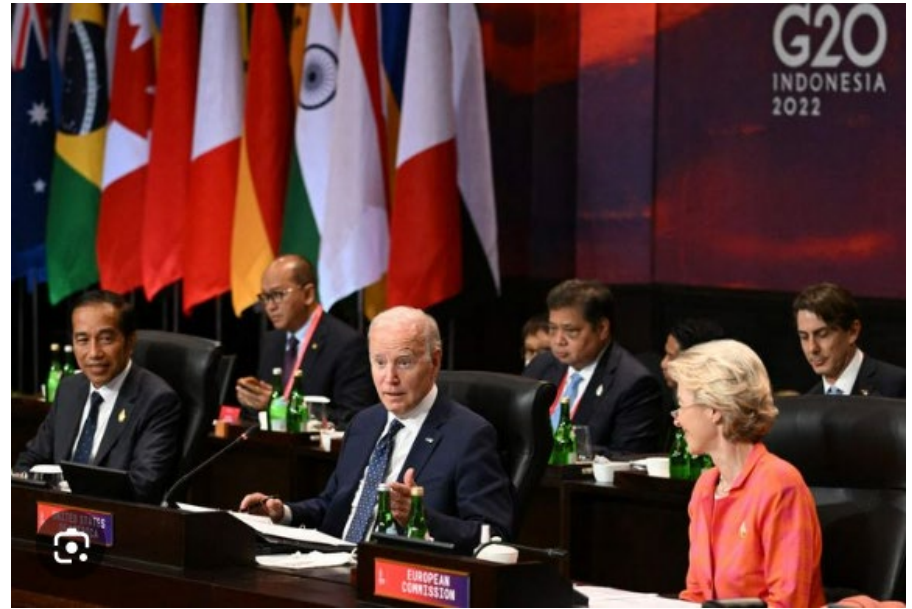
# SPCs and Just Energy Transition Partnerships

## Country JETP

- Indonesia
- South Africa
- Vietnam
- Senegal

## SPC

- PLN
- Eskom
- EdV
- Senelec



# CG for SPC climate finance?

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Mobilizing private capital for SPC climate action: a consultative group

*Proposed Membership:*

- *SPCs (leaders)*
- *Private capital actors*
- *MDB/DFIs*
- *Think tanks/energy agency/facilitators,*
- *Others*



# Concluding thoughts

# Some Final Thoughts

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1. SPCs will be key drivers of global emissions (including low-carbon), especially given weight in emerging economies
2. ...but have not been given appropriate level of attention in international climate discourse on policies and tools
3. SPCs differ from their private sector counterparts, opening up new avenues for government action and tempering others
4. Carbon pricing tools are useful – but likely more muted impact on government-owned enterprises than private sector
5. Government climate toolkit re: SPCs includes exercising shareholder power, potentially more impactful than pricing
7. But SPCs differ greatly across countries and contexts, which is a crucial factor in choosing the right policy
8. SPCs can be strong players in decarbonizing systems
9. **Sustained government commitment to climate is key**



## ENGAGING STATE-OWNED ENTERPRISES IN CLIMATE ACTION

BY PHILIPPE BENOIT  
SEPTEMBER 2019

## GREENHOUSE GAS EMISSIONS FROM STATE-OWNED ENTERPRISES: A PRELIMINARY INVENTORY

BY ALEX CLARK AND PHILIPPE BENOIT  
FEBRUARY 2022

### Decarbonization in state-owned power companies: Lessons from a comparative analysis

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#### ABSTRACT

A rapid decarbonization of the electricity system is urgently required for the Paris Agreement objectives to stand a reasonable chance of being met. While state-owned power companies (SOPCs) are the dominant firm type in the global electricity sector, representing nearly two thirds of global electric power generation capacity, most climate policy literature focuses on private sector companies when analyzing decarbonization interventions. SOPCs' distinct corporate governance structures, objectives, relationships with government, and sources of finance, however, can be markedly different from those of private companies. Here, we develop a framework for analyzing the extent to which common and divergent features of SOPCs, and the markets in which they operate, affect their relationship to government interventions on decarbonization. We also consider the implications of these relationships for the effective implementation of sector-wide decarbonization strategies. We then apply this framework using a comparative case study analysis of six major SOPCs, and highlight how differences in their agency, motivation, capacity, and market exposure may result in different potential responsiveness to government regulatory, policy and market interventions on decarbonization. We generalize these findings by developing four SOPC archetypes and illustrate how they might respond differently to government interventions targeting decarbonization. Our analysis points that SOPCs can, under the guidance of governments pursuing ambitious climate policy, be more effective vehicles for decarbonization relative to private sector companies, particularly when they operate with a high degree of operational independence, are insulated from competitive pressures, and have the financial and technical capacity to invest in the decarbonization of their asset base. Similarly, market-wide policy interventions, such as carbon pricing mechanisms, could in practice be less effective interventions with respect to SOPCs than their private counterparts when the SOPC is ill-equipped to translate these incentives into decarbonization action because it is mandated to pursue supplementary objectives other than profit maximization alone. Ultimately, governments will need to step up their climate action to achieve carbon neutrality. SOPCs can, and where they are major market players, decarbonization when the appropriate interventions are utilized and the attention in the climate policy debate.

#### 1. Introduction

##### 1.1. The power sector and the Paris Agreement

CLIMATE POLICY  
<https://doi.org/10.1080/14693062.2022.2062285>

#### RESEARCH ARTICLE

### Government shareholders, wasted resources and climate ambitions: why is China still building new coal-fired power plants?

Alex Clark<sup>a</sup>, Philippe Benoit<sup>b</sup> and Jonathan Walters<sup>c</sup>

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<sup>b</sup>Center on Global Energy Policy, Columbia University, New York, NY, USA; <sup>c</sup>Oxford Institute for Energy Studies, Oxford, UK

#### ABSTRACT

Despite its carbon neutrality commitments and the prospect of increasingly stringent climate policy measures, China is continuing to build new coal-fired power plants. In assessing the expected performance of these investments, it is helpful to analyse them through an 'economic' framework measuring a broader view of the country-level economic returns on new coal power investments, as a complement to the plant-level financial analysis framework commonly used to assess stranded asset risks. This simplified economic framework, in which inputs and outputs are measured according to the costs and benefits they generate for the national economy, leads to markedly different dynamics than financial analysis alone. This framework can help China to avoid 'wasting' scarce public resources by over-investing in new uneconomic power plants through its state-owned enterprises. Applying this approach to a representative new coal plant in China shows that modest shadow carbon pricing (rising from US\$15/tCO<sub>2</sub>e in 2026, to US\$30/tCO<sub>2</sub>e in 2041) eliminates the expected value of the project to China's economy. Caps on coal-fired electricity generation have less impact on economic returns, but severely undermine financial returns, potentially making such caps a more effective short-term policy tool to dissuade company executives from making new coal investments. Without carbon pricing, only a moratorium on coal-fired power generation in 2030 or earlier prevents new plants from realizing a positive economic return. Comparing these results with an alternative solar/storage investment suggests the renewable option generates higher economic returns than the coal plant under modest shadow carbon pricing and lower electricity storage costs.

#### Key policy insights:

- Economic analysis of proposed coal plants complements plant-level financial analysis and better captures governments' interests in these projects. Both economic and financial analyses are relevant to the decision-making of government shareholders.
- State-led coal plant investments in China today is likely to be economically wasteful under modest future climate policy scenarios, particularly in light of declining levelized costs of renewable alternatives.
- This framework for combined financial and economic analysis also applies to other countries' proposed investments in carbon-intensive power generation. The framework is particularly pertinent for countries with state-led coal power investments planned, including India, Indonesia, Pakistan, South Africa, and Vietnam.

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of the global total (ClimateWatch, 2020) governments have either announced or pledged zero emissions, including China (peak 2060), Japan, the United States, South Korea, New Zealand, Chile, and the United Kingdom (Intelligence Unit, 2021). These nations that economy-wide decarbonization, require advanced economic

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## Decarbonising state-owned power companies: A framework for applying policy actions

Moritz Schwarz, Philippe Benoit, Alex Clark

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