How not to industrialise?

Industrialisation without Energy, cannot be good for economic growth and employment creation

Mohau Moahludi

Introduction

- The Russian-Ukrainian impasse has led to a global economic stalemate, with the West imposing sanctions on Russia, to a grave extent to their own economic detriment. **The sanctions meted against Russia has spelt a reduction in the exports of energy, which in turn have elevated and ultimately led to higher inflation outcome and in all likelihood expectations going forward(IMF,2022)(World Bank,2022).**

- According Adhikari and Chen(2012), **energy is a critical contributor to global economy, and noting that for over four decades, because of the scarcity of energy resources starting from first and second energy crisis in 1973 and 1979, respectively**

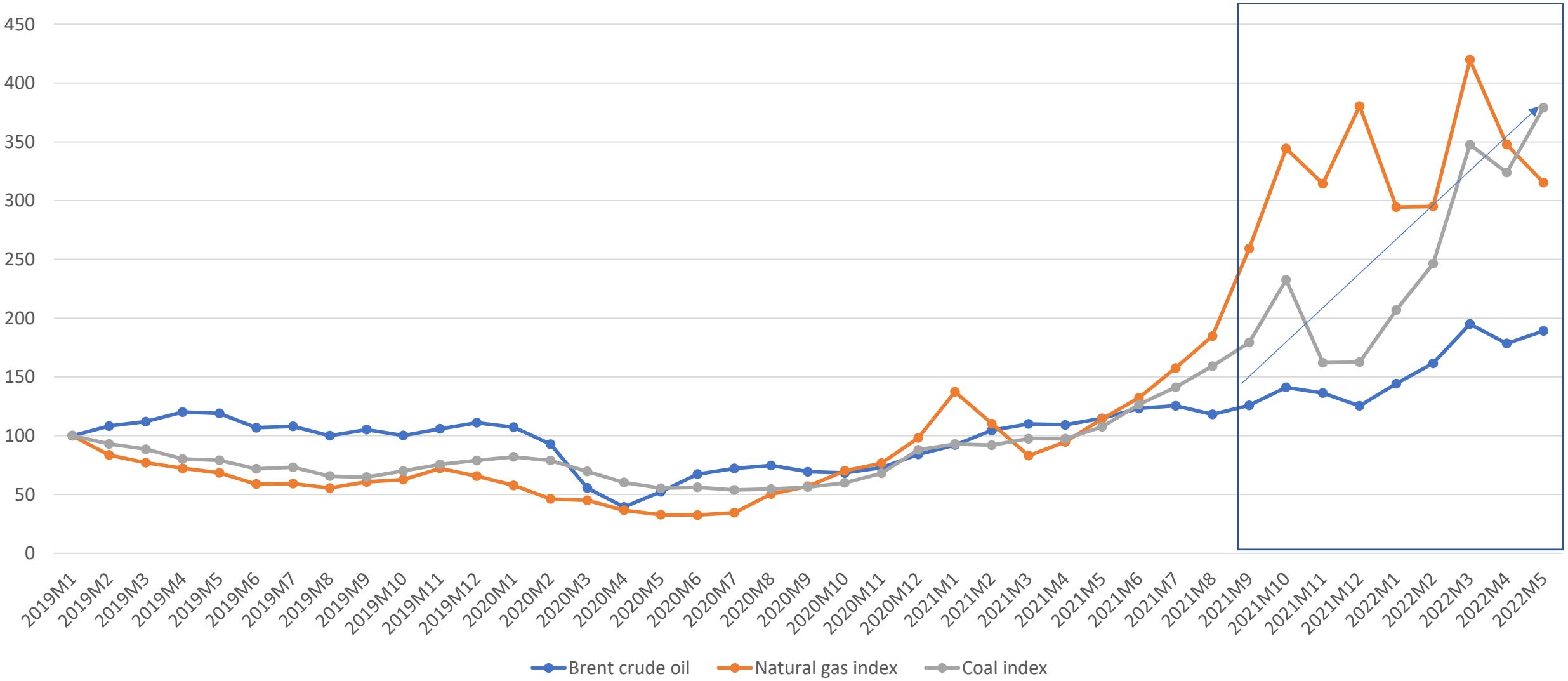
- Loadshedding is detrimental to the South African economy, and could potentially thwart the developmental aspiration of the country. **Frequent load shedding is an impediment to conducting business in South Africa**.

- According to the Council of Scientific Industrial Research (CSIR), loadshedding could have potentially cost South Africa over R560 billion in 2022. The CSIR (2022), acceded to the fact that 2022 overtook 2021, as the most intensive loadshedding year yet, noting that loadshedding was four (4) times more in 2022.

Nuances in understanding manufacturing and energy

- Kaldor is accorded the honour of being one of the finest scholars of development, thus lauded with one of those whose earlier work attempted to understand the impact of the manufacturing sector on economic growth.
- Kaldor (1966) refers to what he terms Verdoorn's Law, the statistical relationship between the rate of growth of labour productivity and the rate of growth of output, as evidence of the pervasive existence in industrial economies of static and dynamic economies of scale (Destefanis, 2002).
- Thus, Bokosi(2022) accede that the faster growth in the manufacturing output and productivity is often associated with GDP growth. Which in turn leads to the increase in demand for manufactured goods – leading to increased levels of investments and exports in the economy (Bokosi, 2022) (Kaldor, 1966).
- Indsutrialisation remains one of the key tools to transform the economic landscape in Southern Africa, and the successful implementation of industrialisation strategies among countries in the regions will be a clear path to economic development
- In the South African context, Zalk (2014) states that the role of manufacturing in South Africa's economic development process should not be ignored, in fact suggest that ignore this at own peril.

Unprecedented surge in commodity price indices – amid Russo-Ukrainian impasse



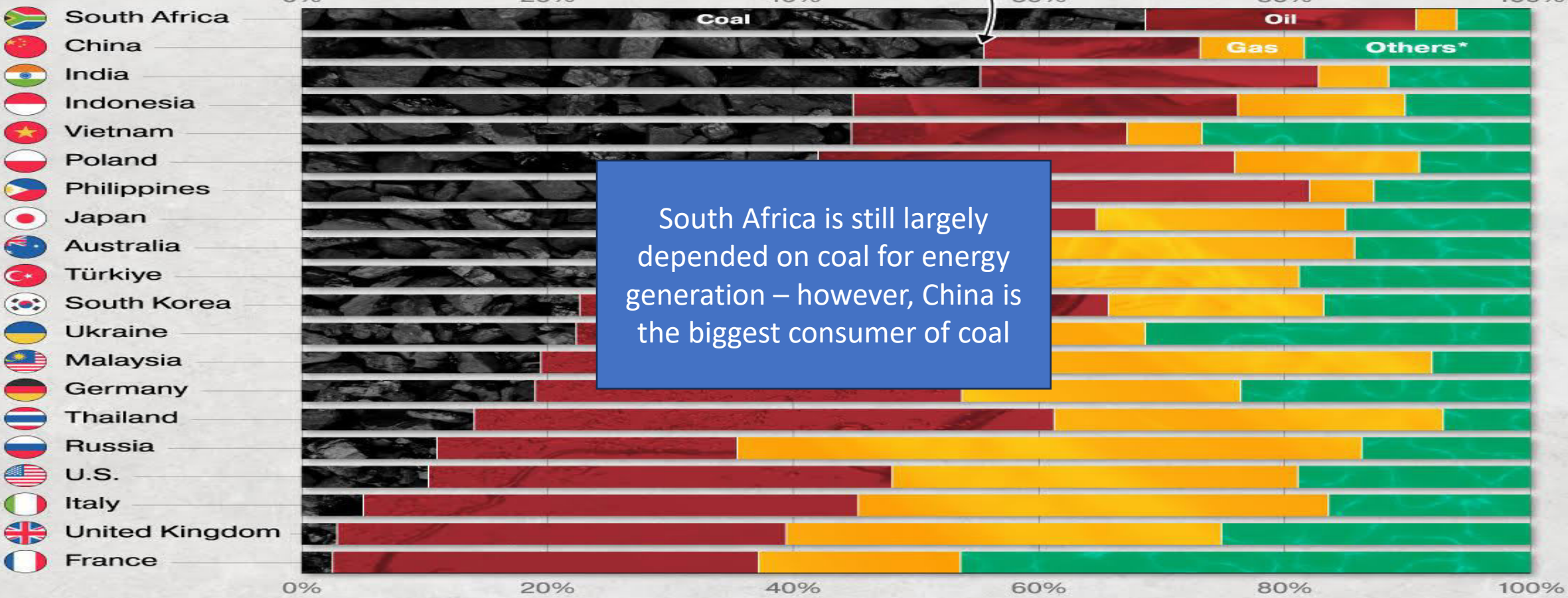
Visualizing Nations'

Reliance on Coal

Despite efforts to reduce carbon emissions, fossil fuels still account for more than **82%** of primary energy use globally.

Share of Energy Consumption by Fuel in 2022

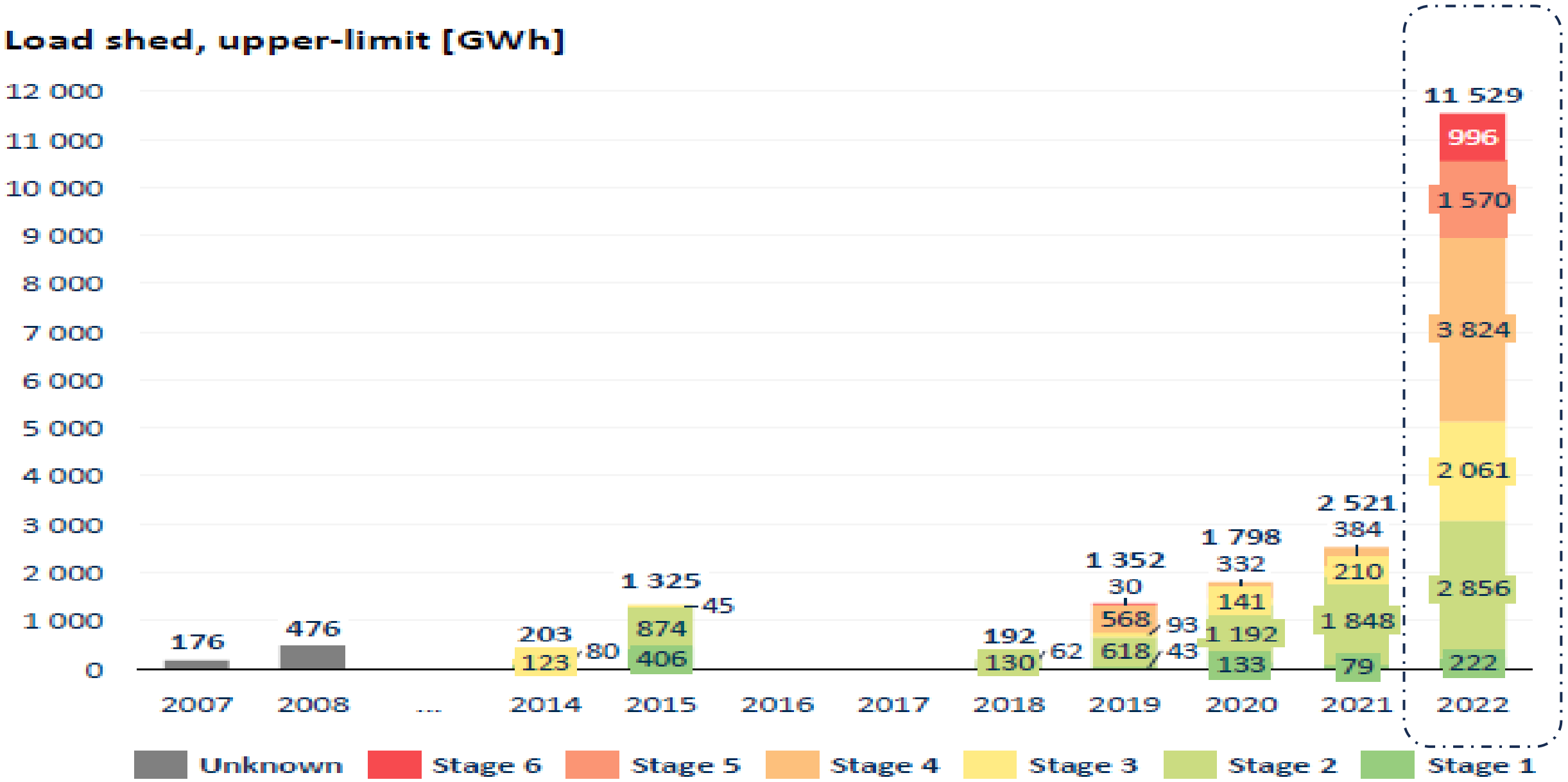
China consumed **over 4 billion tonnes** of coal in 2022, more coal than the rest of the world combined.



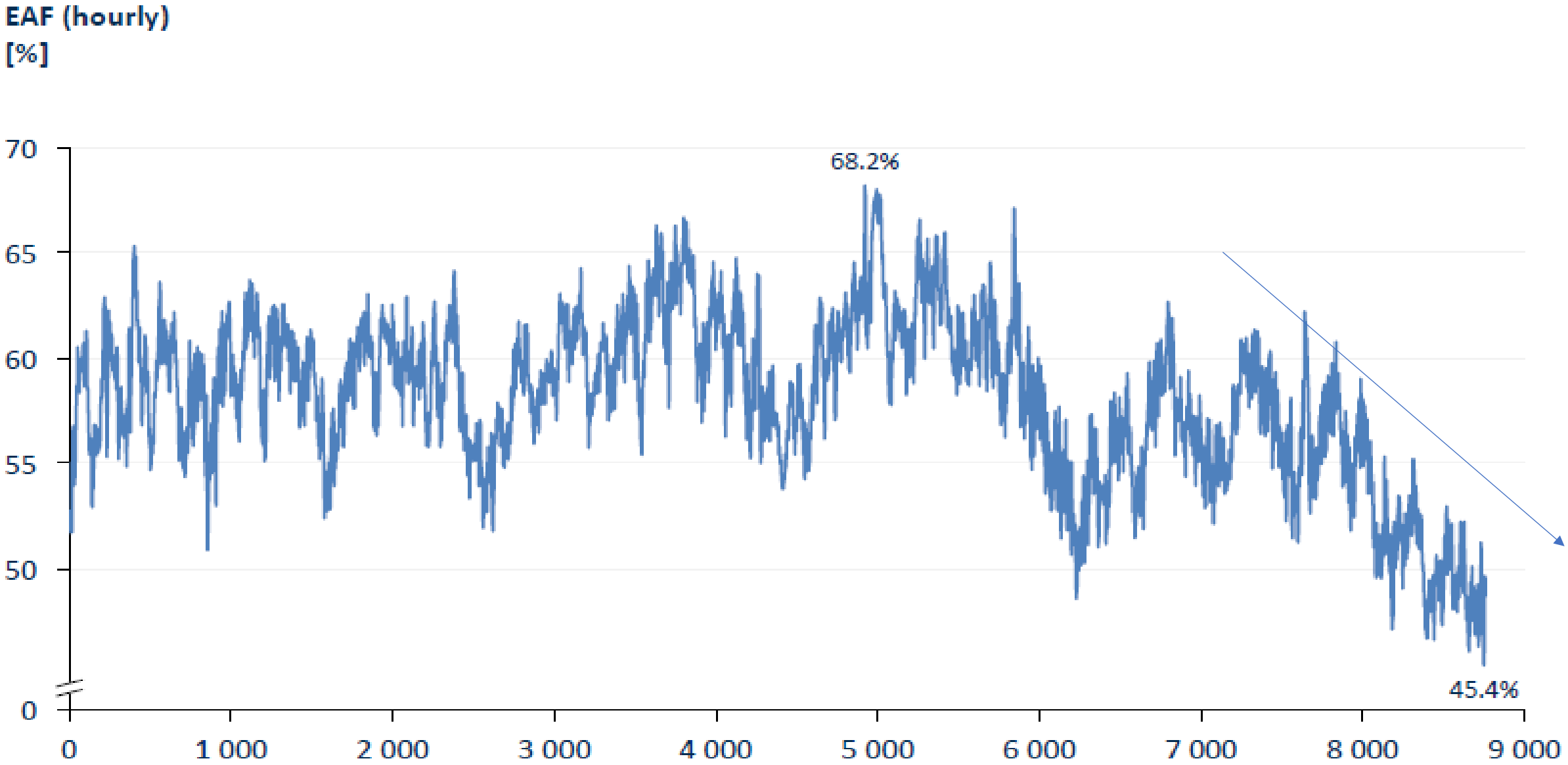
Source: Statistical Review of World Energy 2023

**Others include nuclear energy, hydroelectric power and other renewables.*

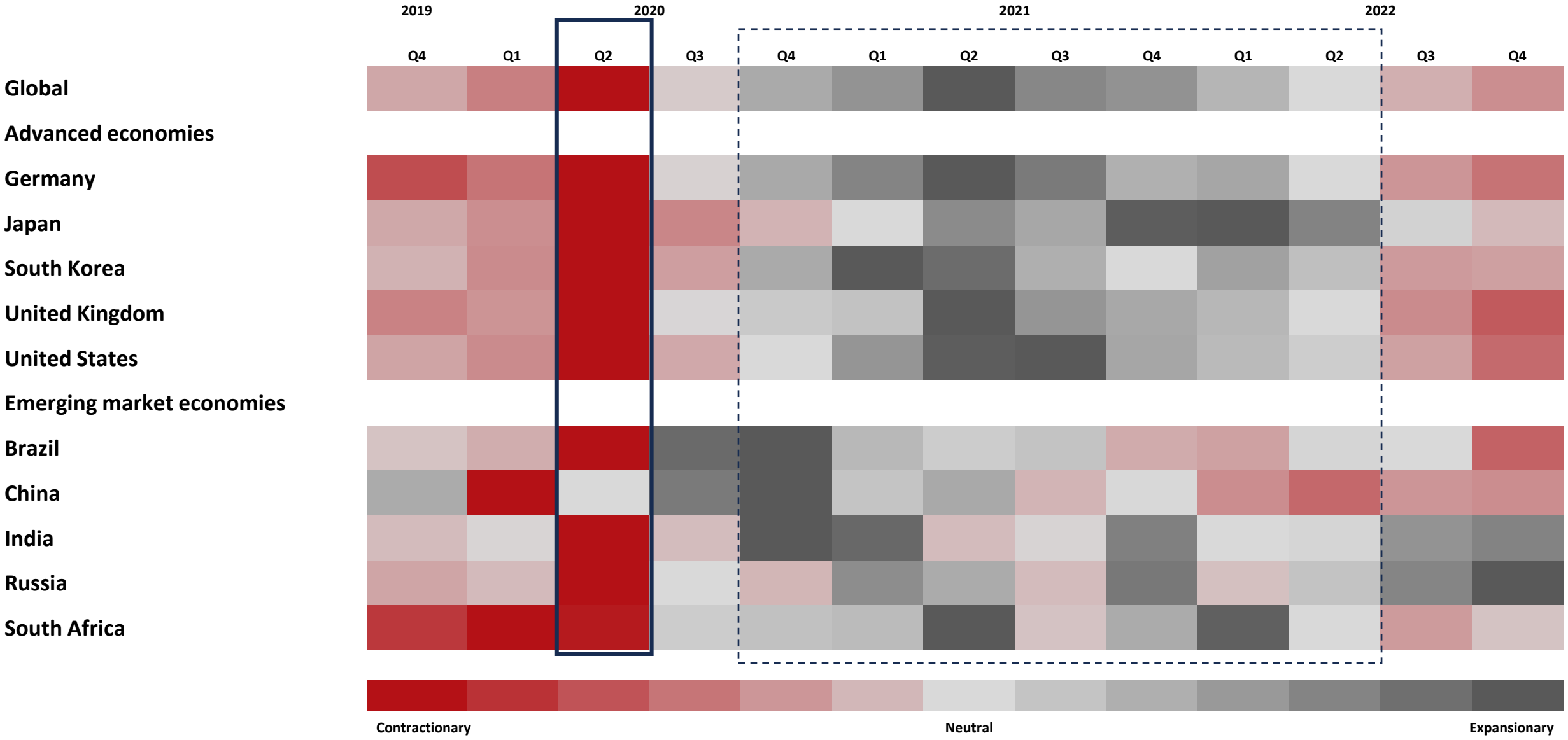
South Africa's loadshedding scenario – 3 773 hrs of loadshedding – intensive loadshedding experienced(CSIR,2022)



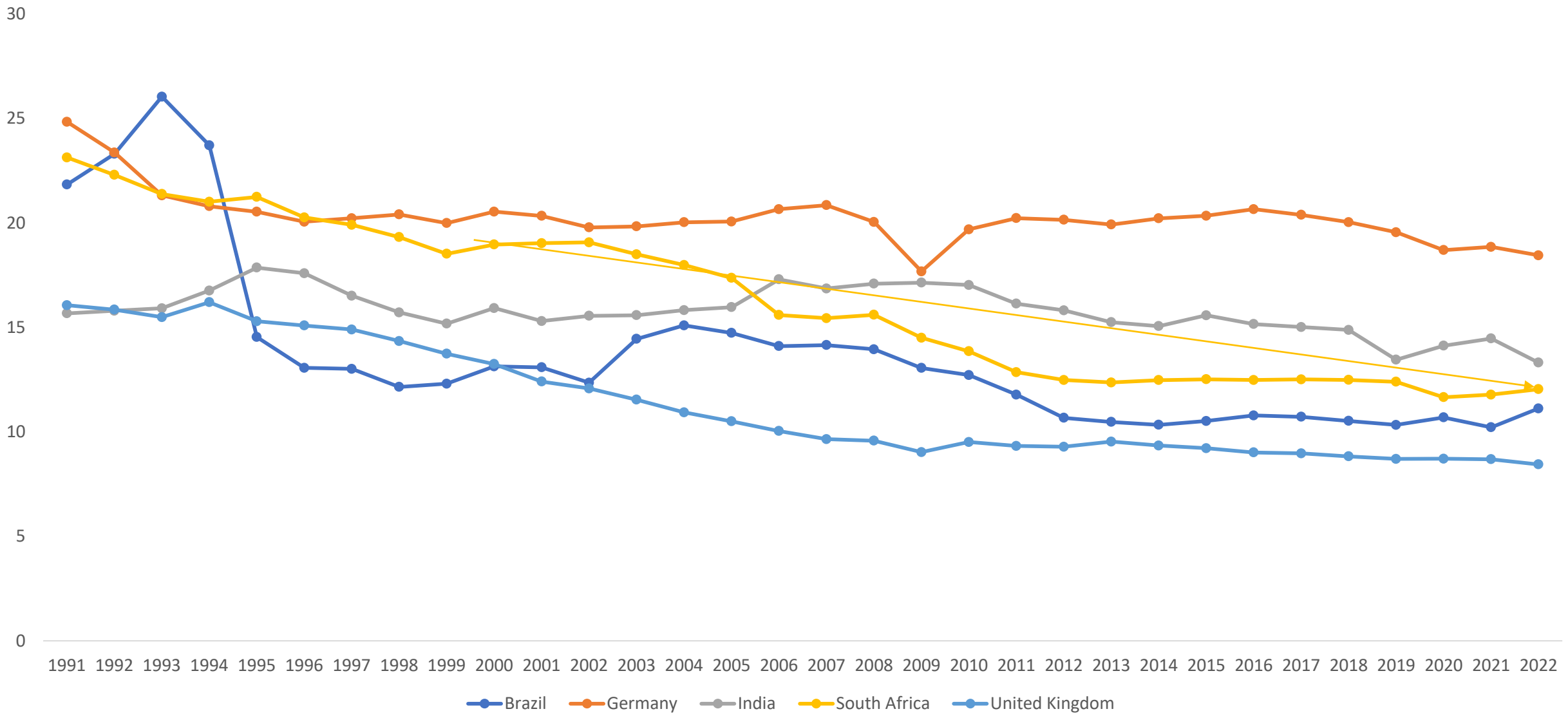
Eskom fleet Energy Availability Factor(EAF) declining hourly – CSIR(2022)



Global Manufacturing Purchasing Manager's Index(NT,2023)



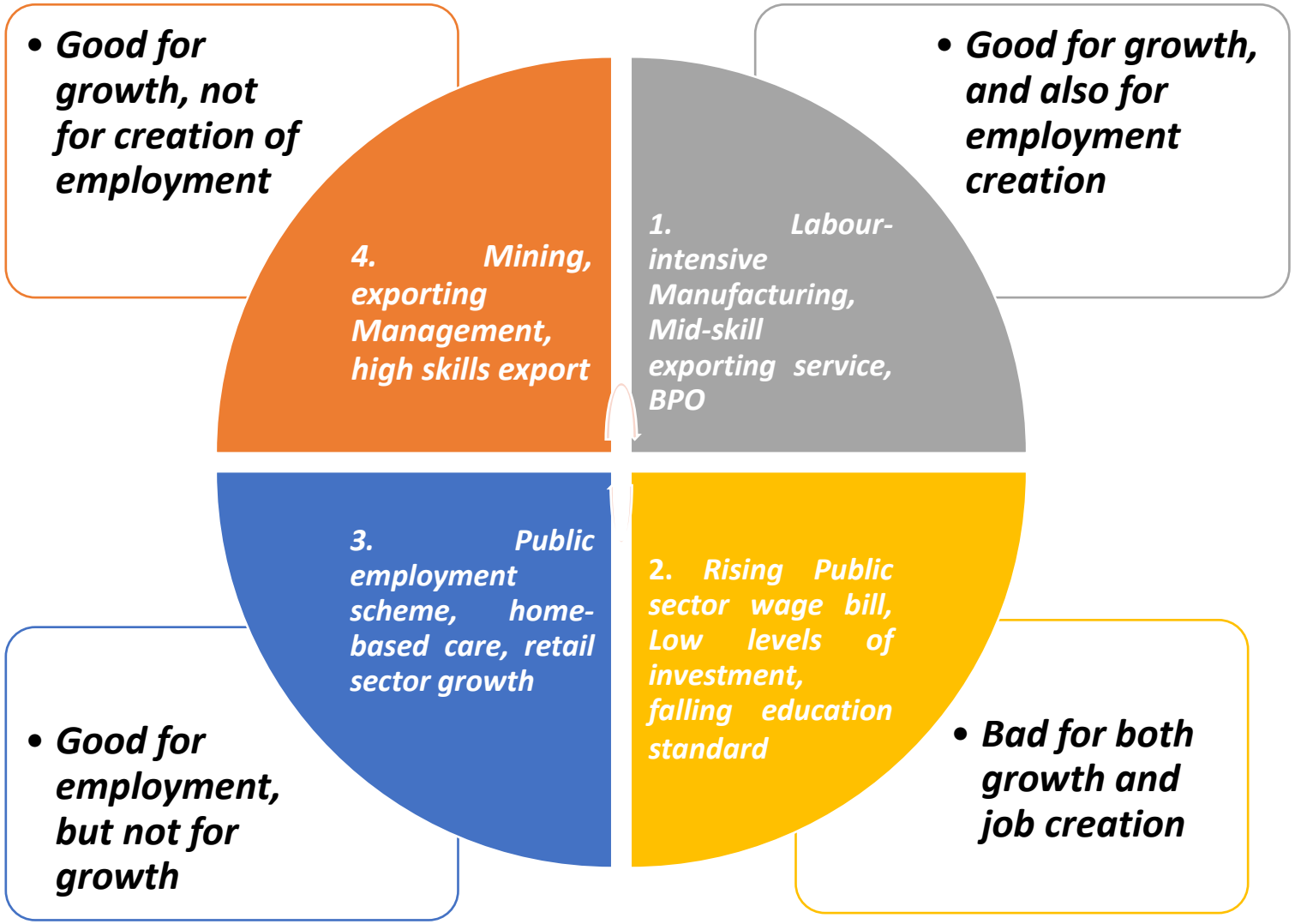
General decline - Selected countries - Manufacturing as a percentage of GDP(WDI, 2023)



Possible Growth Outcomes Give Rate of Industrialisation and Level of Capabilities(Rodrik,2013)

		Rate of industrialisation	
		Slow	**Rapid**
Level of Capabilities	**Low**	(1) No or very little growth	(2) Episodic growth
	High	(3) Slow growth	(4) Rapid, sustained growth

NDP proposition - Quandary for the creation of jobs and growth



Industrial Development Think Tank(IDTT)

- “South Africa's post-apartheid economic transformation project has not generally delivered a "better life for all" as promised at the dawn of democracy. It is not generating prosperity and economic justice for the majority of the population and suffers from long-standing weaknesses...” (S Roberts, 2018)
    - **Manufacturing is a key sector of the South African economy**. Over and above its direct contribution to overall economic activity (manufacturing accounted for 13.0% of the gross domestic product in 2015), the sector has strong linkages with the rest of the economy.
    - The **manufacturing sector is a critical supplier of intermediate and final consumption products**, as well as an important source of demand for primary products (mineral and agricultural) and various services.
    - Importantly, **the manufacturing sector employs 1.74 million people and(latest 1,63 million – StatsSA(2023)**, through its relatively high multiplier effects, sustains a large number of indirect jobs throughout the economy.
    - Furthermore, manufactured goods accounted for 60.5% of South Africa’s merchandise export basket in 2015(IPAP).

Research questions

- **Specifically this analysis seek to understand and answer the following questions:**
  - Why is the growth of manufacturing sector and electricity provision **irresponsive**
  - Is there any **long-run and/or short-run relationship** between the growth of manufacturing sector and electricity provision, as well as economic growth and investment.
  - If any, what is the **direction of causality** between manufacturing sector's growth and electricity provision, invest and the labour market
  - What are the **probable causes or the binding constraints** undermining the industrialisation trajectory

Advanced econometric methodologies employed

- Advanced econometric methodologies employed in this analysis are geared towards determine the long-run and dynamic causality between manufacturing growth, electricity provision, economic growth, investment, and unemployment. The methodology comprises the following steps.:

  - 1) Correlation coefficient analysis testing
  - 2) Panel unit root test
  - 3) Panel cointegration tests, such as the Westerlund and Pedroni as well as the Kao tests
  - 4) Parameter estimation using the pool mean group (PMG) approach (Abu Zar Md. Shafiullaha, 2021), and the
  - 5) Sway estimation.

Econometric model for the analysis

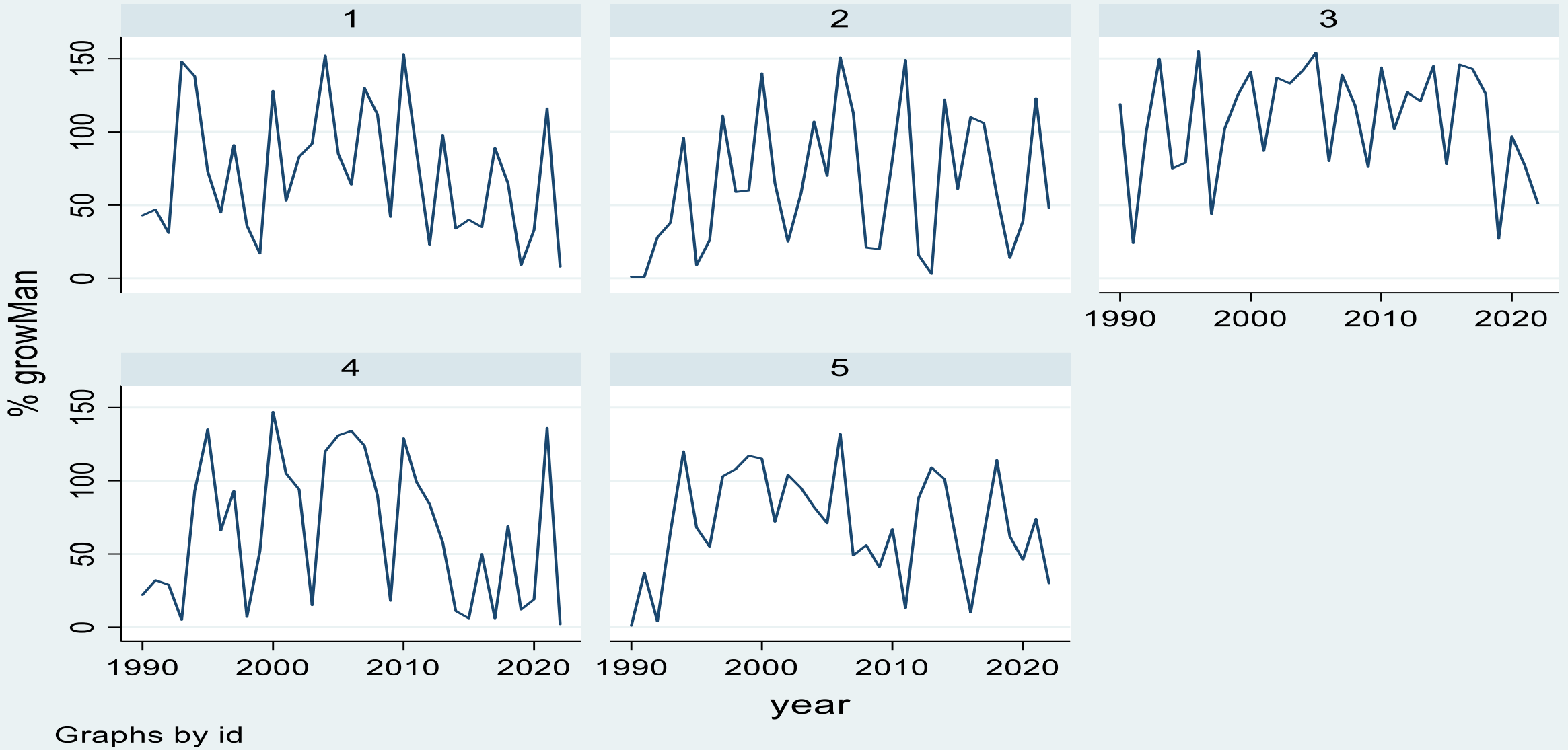
- To examine the relationship between manufacturing growth, the provision of electricity, economic growth, invest, and unemployment, the analysis considers the following model. With the control variables in the analysis being invest and unemployment. Equation 1 describes the model's function:

  - $Manugrowth = f\ (eleckwh_{it}, GDPgrowth_{it}, invest_{it}, unempl_{it})$.....(1)

- This is a basic multivariate framework is used to find the link between the variables of interest. A process of smoothing the data by transforming some of the series data into their natural logarithm, with the exception of the major component scores of energy poverty. This conversion, when compared to a basic linear approach, helps to eliminate autocorrelation and heteroscedasticity problems while also providing more accurate and reliable results. Equation 2 shows the model in log-linear form:

  - $Manugrowth = \alpha + \beta_1(lneleckwh_{it}) + \beta_2(GDPgrowth_{it}) + \beta_3(lninvest_{it}) + \beta_4(lnunempl_{it}) + \varepsilon_{it}$ .....(2)

Manufacturing growth of the selected countries overtime



Panel Unit Root Test - It is evident that all the variables except Lninvest are stationary

Variables	Unit Root test	Statistic	Prob.
GDPgrowth	IPS	-4.3341	
		-3.4084	
		-5.5376	0.0000
	LLC	-4.7705	0.0000
		-4.6318	0.0000
Manugrowth	IPS	-5.4090	
		-3.8616	
		-6.8166	0.0000
	LLC	-8.0196	0.0000
		-7.7779	0.0000
Eleckwh	IPS	-0.9954	
		-0.9563	
		1.3825	0.9166
	LLC	-2.9142	0.0018
		-2.8265	0.0024
Invest	IPS	-2.0073	
		-1.8912	
		-1.2559	0.1046
	LLC	-1.1009	0.1355
		-1.0721	0.1418
Unemploy	IPS	-3.1684	
		-2.7159	
		-3.5878	0.0002
	LLC		

Panel Cointegration Tests

	Statistic	p-value
Variance ratio	-1.8558	0.0317

Westerlund test suggest that there is an existence of a cointegration relationship for the selected panel, meaning that the variables tend to move together in the long-run

	Statistic	p-value
Modified Phillips-Perron t	0.8902	0.1867
Phillips-Perron t	-14.7588	0.0000
Augmented Dickey-Fuller t	-10.2169	0.0000

Pedroni test for cointegration – similar to the Westerlund test suggest the null hypothesis can be rejected for no cointegration in the panel. This infers that there exist a long-run cointegrated relationship amongst the variables in the panel.

	Statistic	p-value
Modified Dickey-Fuller t	0.7244	0.2344
Dickey-Fuller t	-1.5532	0.0602
Augmented Dickey-Fuller t	-1.0815	0.1397
Unadjusted modified Dickey-Fuller t	-16.3908	0.0000
Unadjusted Dickey-Fuller t	-11.0887	0.0000

The Kao Test for cointegration reveals a mixed bag of results. However, in the overall estimation the null hypothesis of no cointegration is rejected. Thus, inferentially there could exist a long-run cointegrated relationship amongst the variables in the panel.

FE Regression results – electricity provision has positive effect on manufacturing growth

Manugrowth	Coef.	Std. Error	t	P>|t|	[95% Conf. Interval]	
gdpgrowth	7.61422	1.115634	6.83	0.000	5.410298	9.818141
invest	-.2013108	.1260434	-1.60	0.112	-.4503081	.0476865
eleckwh	2.242059	1.038653	2.16	0.032	.1902136	4.293905
unempl	-.1085042	.0854798	-1.27	0.206	-.2773686	.0603602
_cons	66.67073	11.61134	5.74	0.000	43.73267	89.60879

Manugrowth	Coef.	Std. Error	t	P>|t|	[95% Conf. Interval]	
gdpgrowth	7.61422	1.922299	3.96	0.017	2.277063	12.95138
invest	-.2013108	.132386	-1.52	0.203	-.5688733	.1662517
eleckwh	2.242059	1.031046	2.17	0.095	-.6205825	5.104701
unempl	-.1085042	.0206915	-5.24	0.006	-.165953	-.0510554
_cons	66.67073	15.54758	4.29	0.013	23.50371	109.8377

RE Regression results – electricity provision meets the theoretical expectation, however, fails the statistical significance test

Manugrowth	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
gdpgrowth	8.299777	1.013692	8.19	0.000	6.312976	10.28658
invest	.0090907	.0721519	0.13	0.900	-.1323246	.1505059
eleckwh	1.416682	.9748867	1.45	0.146	-.4940609	3.327425
unempl	-.0737683	.0836356	-0.88	0.378	-.237691	.0901545
_cons	50.02957	8.536213	5.86	0.000	33.2989	66.76024

Manugrowth	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
gdpgrowth	8.299777	1.426784	5.82	0.000	5.503331	11.09622
invest	.0090907	.0835148	0.11	0.913	-.1545953	.1727766
eleckwh	1.416682	.8873024	1.60	0.110	-.3223989	3.155763
unempl	-.0737683	.0401976	-1.84	0.066	-.152554	.0050175
_cons	50.02957	9.187887	5.45	0.000	32.02164	68.0375

Economic growth is good for the growth of manufacturing sector – both in the short and long-run

D.Manugrowth		Coef.	Std Err.	z	P>|z|	[95%	Conf.
__ec							
	eleckwh	-.0423204	1.074255	-0.04	0.969	-2.147821	2.06318
	gdpgrowth	12.72932	1.776085	7.17	0.000	9.248253	16.21038
	invest	-.0531062	.1059534	-0.50	0.616	-.260771	.1545585
	unempl	-.0979199	.0748014	-1.31	0.191	-.2445279	.0486882
Short-Run	|						
	__ec	.9652917	.0840929	11.48	0.000	.8004727	1.130111
	|						
	eleckwh						
	D1.	1.150469	2.435366	0.47	0.637	-3.622761	5.923698
	|						
	gdpgrowth						
	D1.	9.141502	.8571467	10.67	0.000	7.461525	10.82148
	|						
	invest						
	D1.	-.2074294	.2084958	-0.99	0.320	-.6160736	.2012149
	|						
	unempl						
	D1.	-.1514255	.1721268	-0.88	0.379	-.4887878	.1859368
	|						
	_cons	-52.71189	4.091474	-12.88	0.000	-60.73103	-44.69274

Sway – Group specific regression results

Group-specific					
		Coef.	Std.Err.	z	P>|z|
Brazil					
gdpgrowth	|	11.01563	2.093772	5.26	0.000
eleckwh	|	1.25	1.111297	1.12	0.261
unempl	|	-.1074219	.1047147	-1.03	0.305
invest	|	-.015625	.1535092	-0.10	0.919
_cons	|	50	13.14502	3.80	0.000
Germany					
gdpgrowth	|	10.5	2.806441	3.74	0.000
eleckwh	|	-2.5	1.921663	-1.30	0.193
unempl	|	0	.1352688	0.00	1.000
invest	|	-.75	.4368702	-1.72	0.086
_cons	|	144	48.73517	2.95	0.003
India					
gdpgrowth	|	11.125	4.603914	2.42	0.016
eleckwh	|	1	2.237985	0.45	0.655
unempl	|	-.125	.1553728	-0.80	0.421
invest	|	.25	.4254191	0.59	0.557
_cons	|	32	69.58129	0.46	0.646
South Africa					
gdpgrowth	|	10.8125	2.624886	4.12	0.000
eleckwh	|	2.34375	1.216602	1.93	0.054
unempl	|	-.109375	.1322236	-0.83	0.408
invest	|	-.078125	.1391282	-0.56	0.574
_cons	|	40	13.32741	3.00	0.003
United Kingdom					
gdpgrowth	|	5.125	2.01914	2.54	0.011
eleckwh	|	2.4375	1.147774	2.12	0.034
unempl	|	-.1875	.1141041	-1.64	0.100
invest	|	-.34375	.1818291	-1.89	0.059
_cons	|	84	16.59708	5.06	0.000

Results indicates that indeed economic growth for the country has a significance positive relationship with the manufacturing sector, which is also statistically significant. As such, a one (1) percent growth in South Africa's economic growth, could potentially translate to a ten percent increase in the manufacturing sector. In terms of the variable of interest, electricity provision – positive and statistically significant relationship is apparent

51.47032	116.5297

In closing

- There's general consensus that industrial policy is chiefly aimed at realising structural change, in that is aims to develops strategic industries and creates this inclusive economy. Industrial development is essential to self-sustaining development of any economy and there is wide agreement among policymakers on the importance of industrial development as the common factor in which all the advanced economies have been built on(TIPS,2016).
- Whilst, it has been empirically established that electricity serves an important role in both the production and consumption of goods and services within an economy. The availability of electricity has been a major contributor to the technological and scientific advancements that have improved the standard of living across countries(Abdulkadir Abdulrashid Rafndadi, 2022).
- Zalk (2014) states that the role of manufacturing in South Africa's economic development process should not be ignored, in fact suggest that ignore this at own peril. That said, the results indicates that indeed economic growth for the country has a significance positive relationship with the manufacturing sector, which is also statistically significant.
- As such, a one (1) percent growth in South Africa's economic growth, could potentially translate to a ten percent increase in the manufacturing sector. In terms of the variable of interest, electricity provision – positive and statistically significant relationship is apparent,