

World Economic Dynamics (WED) Model: Coal consumption modeling and forecasting



РОСНЕФТЬ



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- Economic modeling and forecasting
- Primary energy modeling and forecasting
- Electricity output modeling and forecasting
- Oil consumption modeling and forecasting
- Gas consumption modeling and forecasting
- Coal consumption modeling and forecasting



Modeling and forecasting coal consumption

Additional methods of modeling and forecasting coal consumption in the model WED:

- Coal consumption model (the key consumers)
- Coal intensity calculation

Purpose of additional modeling and forecasting coal consumption:

- Control of the derived coal consumption for countries until 2045, obtained by balancing method;
- Forecasting the coal consumption structure by sectors and structure of the electric power generation by type of resources.

As a result, there will be more qualitative forecast of the coal consumption in the world.

Data source: IEA energy balances

Coal = Anthracite + coking coal + other bituminous coal + sub-bituminous coal + lignite

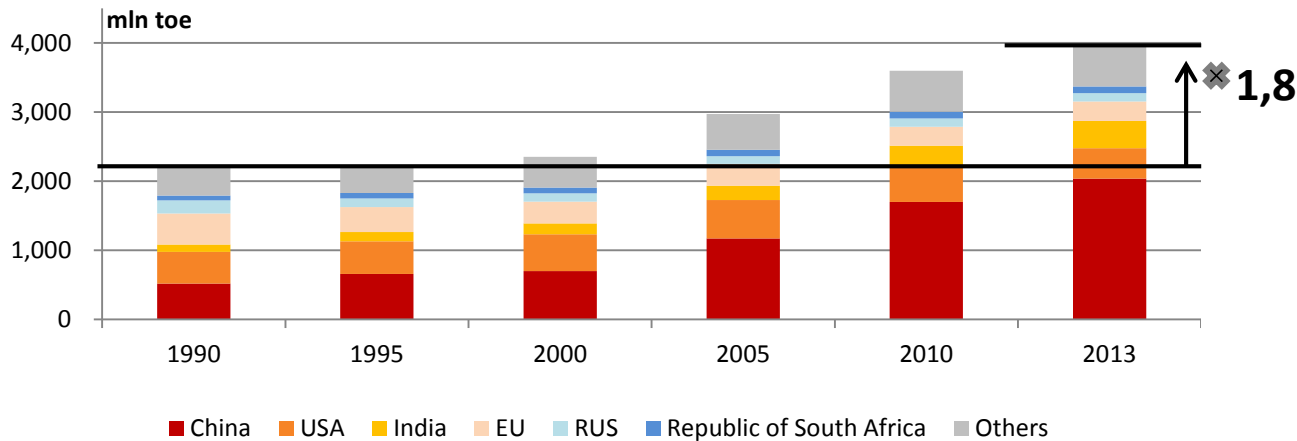


UNIT: ktoe	COUNTRY: World	TIME: 2011	PRODUCT	Anthracite	Coking coal	Other bituminous coal	Sub-bituminous coal	Lignite	Patent fuel	Coke oven coke	Gas coke
FLOW											
Production				56 521	628 335	2 608 423	336 514	216 835	0	0	0
Imports				29 189	176 425	433 168	38 020	1 670	456	15 485	0
Exports				-28 223	-188 361	-429 249	-62 204	-1 316	-112	-15 029	0
International marine bunkers				x	x	x	x	x	x	x	x
International aviation bunkers				x	x	x	x	x	x	x	x
Stock changes				645	-8 312	-33 220	2 422	234	-42	-7 012	0
Total primary energy supply				58 132	608 086	2 579 121	314 752	217 423	302	-6 557	0
Transfers				0	0	0	0	0	0	0	0
Statistical differences				-5 732	-1 803	-119 628	-4 116	-479	-529	-10 151	0
Transformation processes				-19 970	-576 477	-1 856 879	-289 135	-200 516	5 950	121 982	1 435
Main activity producer electricity plants				-13 135	-26 457	-1 557 127	-278 894	-133 628	0	0	0
Autoproducer electricity plants				-220	-2 057	-31 648	-7 670	-991	0	-4	0
Main activity producer CHP plants				-1 929	-689	-91 652	-810	-49 984	0	-3	0
Autoproducer CHP plants				-184	-79	-13 882	-1 235	-3 362	0	0	0
Main activity producer heat plants				-138	-258	-89 242	-37	-184	0	-4	0
Autoproducer heat plants				-1	-83	-9 917	-66	-3 966	0	-7	0
Heat pumps				0	0	0	0	0	0	0	0
Electric boilers				0	0	0	0	0	0	0	0
Chemical heat for electricity production				0	0	0	0	0	0	0	0
Blast furnaces				0	-16 378	-11 183	0	0	0	-292 359	0
Gas works				0	-2 167	-8 716	0	-2 686	0	-732	1 435
Coke ovens				-3 525	-527 233	-20 616	-412	-21	0	415 090	0
Patent fuel plants				-838	0	-7 181	0	0	5 950	0	0
BKB plants				0	0	-3	-10	-4 938	0	0	0
Oil refineries				0	0	0	0	0	0	0	0
Petrochemical plants				0	0	0	0	0	0	0	0
Coal liquefaction plants				0	-1 076	-15 714	0	-756	0	0	0
Gas-to-liquids (GTL) plants				0	0	0	0	0	0	0	0
For blended natural gas				0	0	0	0	0	0	0	0
Charcoal production plants				0	0	0	0	0	0	0	0
Non-specified (transformation)				0	0	0	0	0	0	0	0
Energy industry own use				-11	-3 188	-55 197	-10	-414	-15	-1 048	0
Coal mines				-7	-971	-35 140	-10	-49	-14	-191	0
Oil and gas extraction				0	0	0	0	0	0	0	0
Blast furnaces				0	0	0	0	0	0	-37	0
Gas works				0	0	-304	0	0	0	-5	0
Gasification plants for biogases				0	0	0	0	0	0	0	0
Coke ovens				0	-2 174	-5 745	0	0	0	-711	0

Coal consumption review

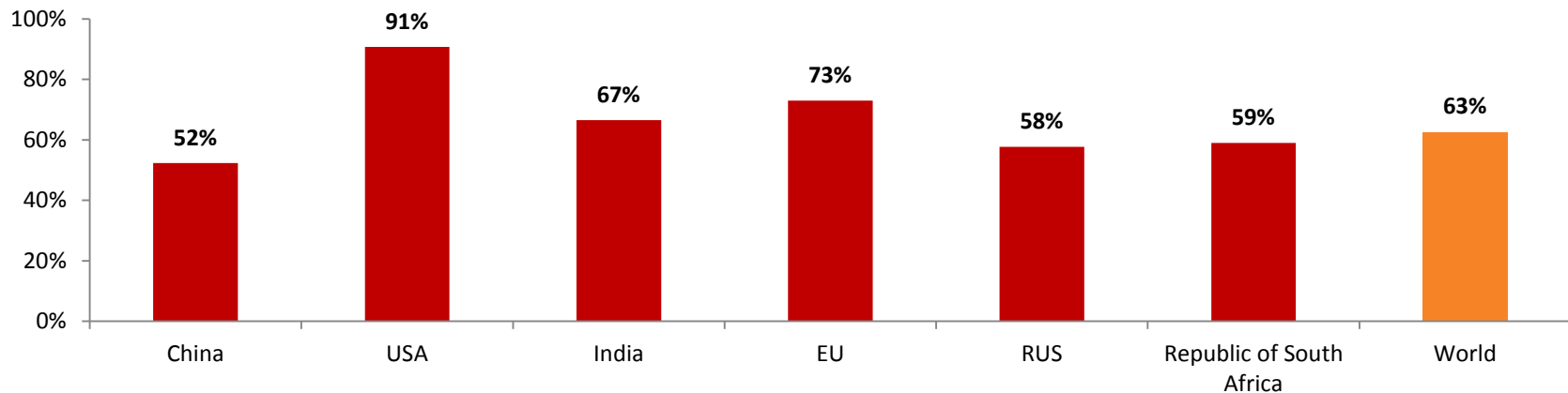


Structure of coal consumption by countries



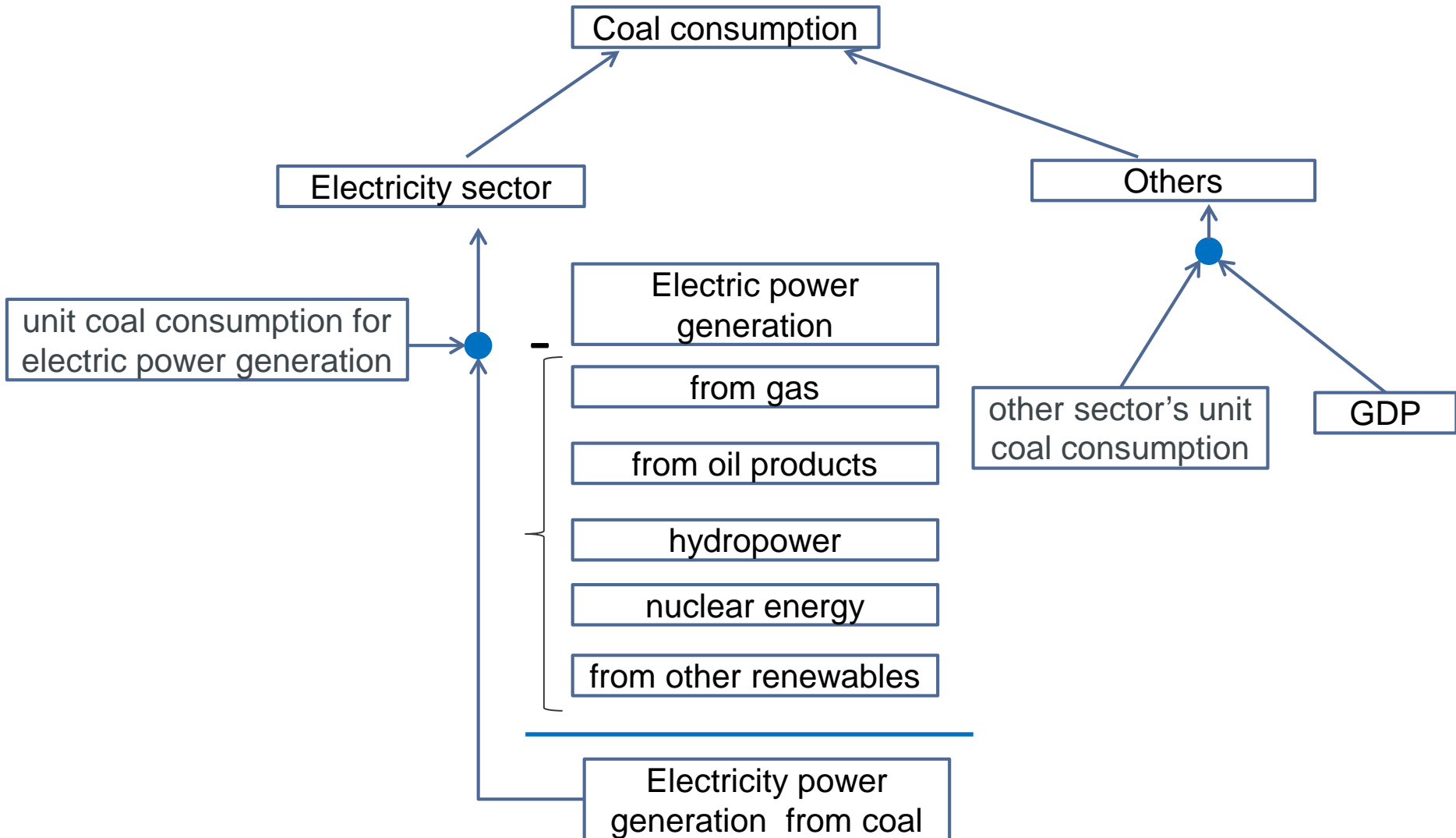
- For the last 23 years the volume of global coal consumption increased by 80% and amounted to about 4 billion toe.
- The amount of China coal consumption in 2013 exceeded the consumption of all other countries, taken together.
- 6 countries account for 85% of the global demand for coal.

Share of coal consumption by electricity sector, 2011





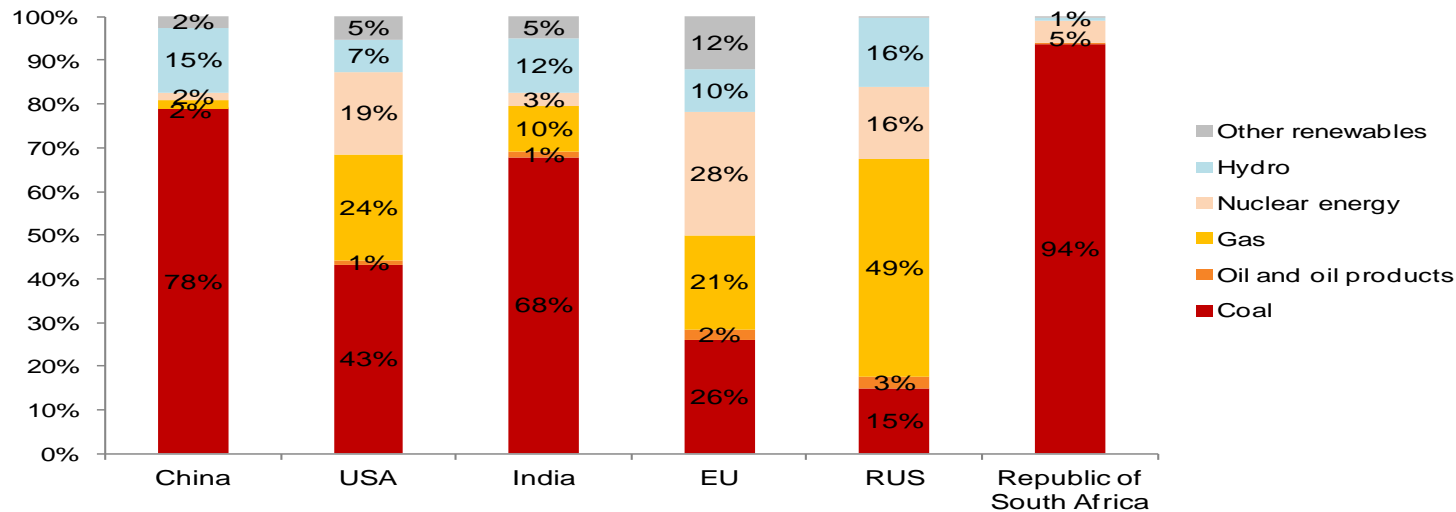
1. Coal consumption model



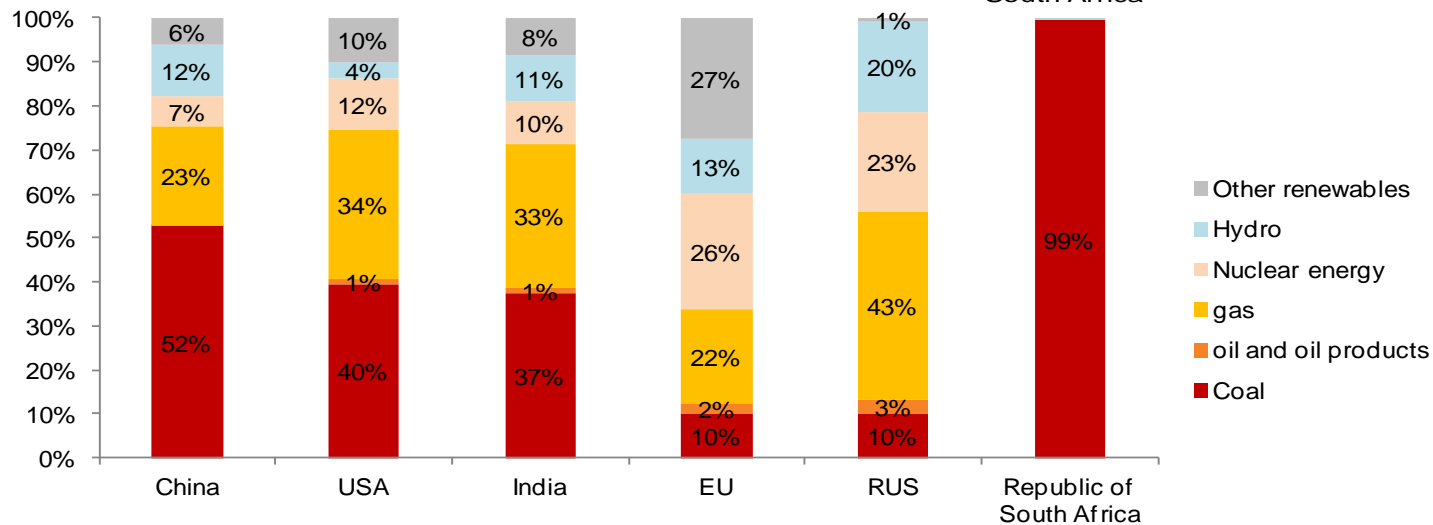
Electricity production structure by types of resources



2011



2045



Assumptions



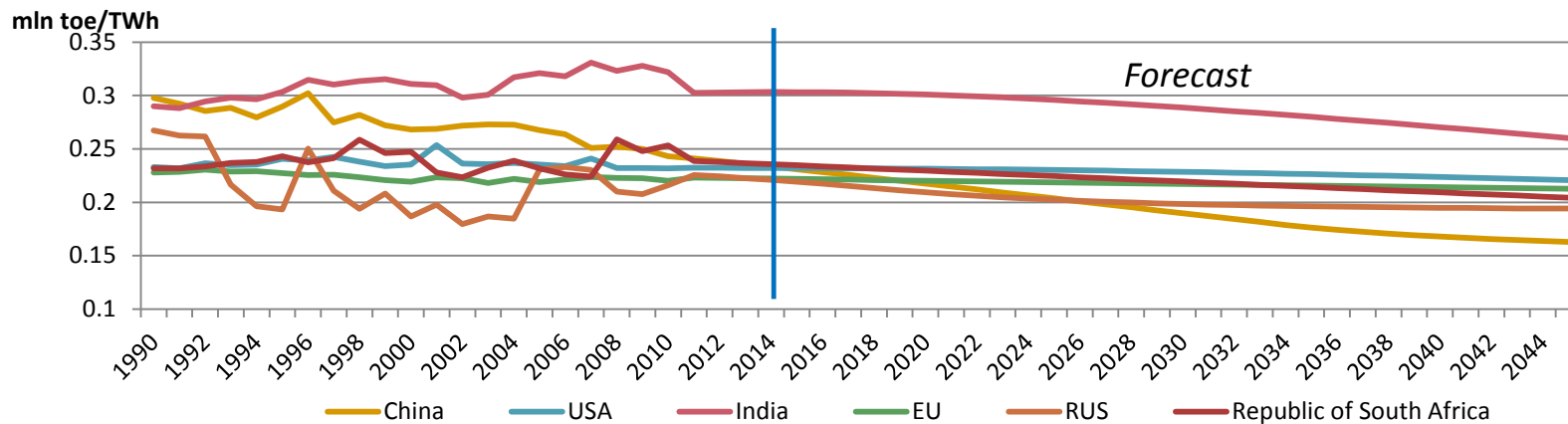
- unit coal consumption for electric power generation should decline in every country (the same method as it was for gas model);
- Due to the fact that the share of electricity production from oil products is minor we consider it to be constant throughout the whole forecasting period;
- The growth of electricity production from other renewables is proportional to the growth of other renewables consumption;
- Other's sector unit coal consumption - the same method as it was for gas model.

The unique characteristics of each country are being taken into account.

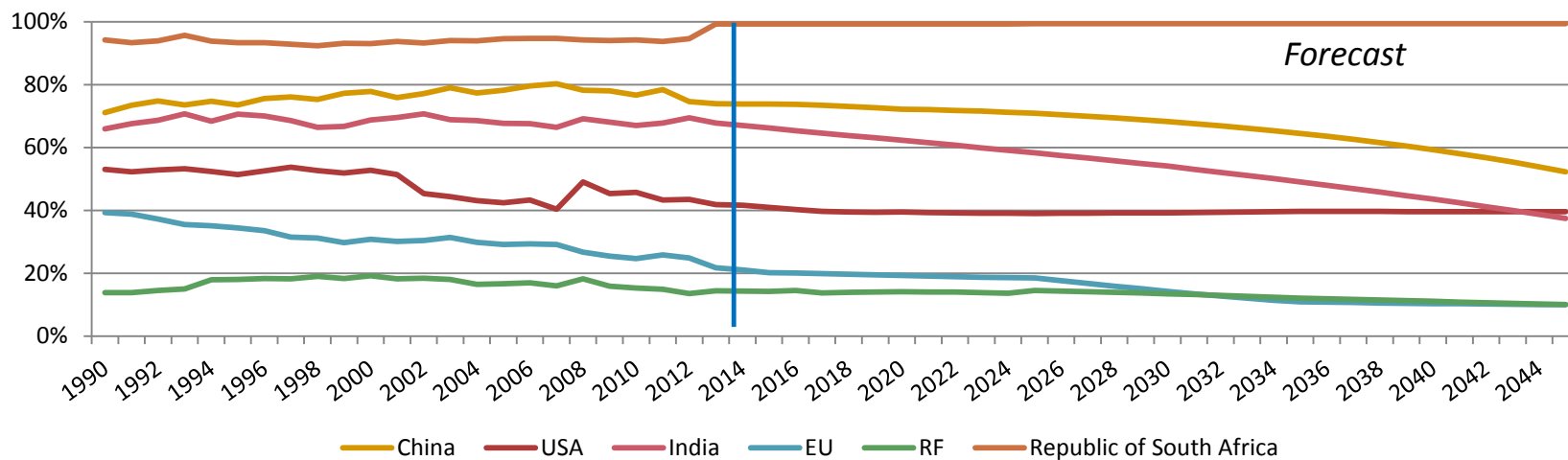
Coal: forecast



unit coal consumption for electric power generation

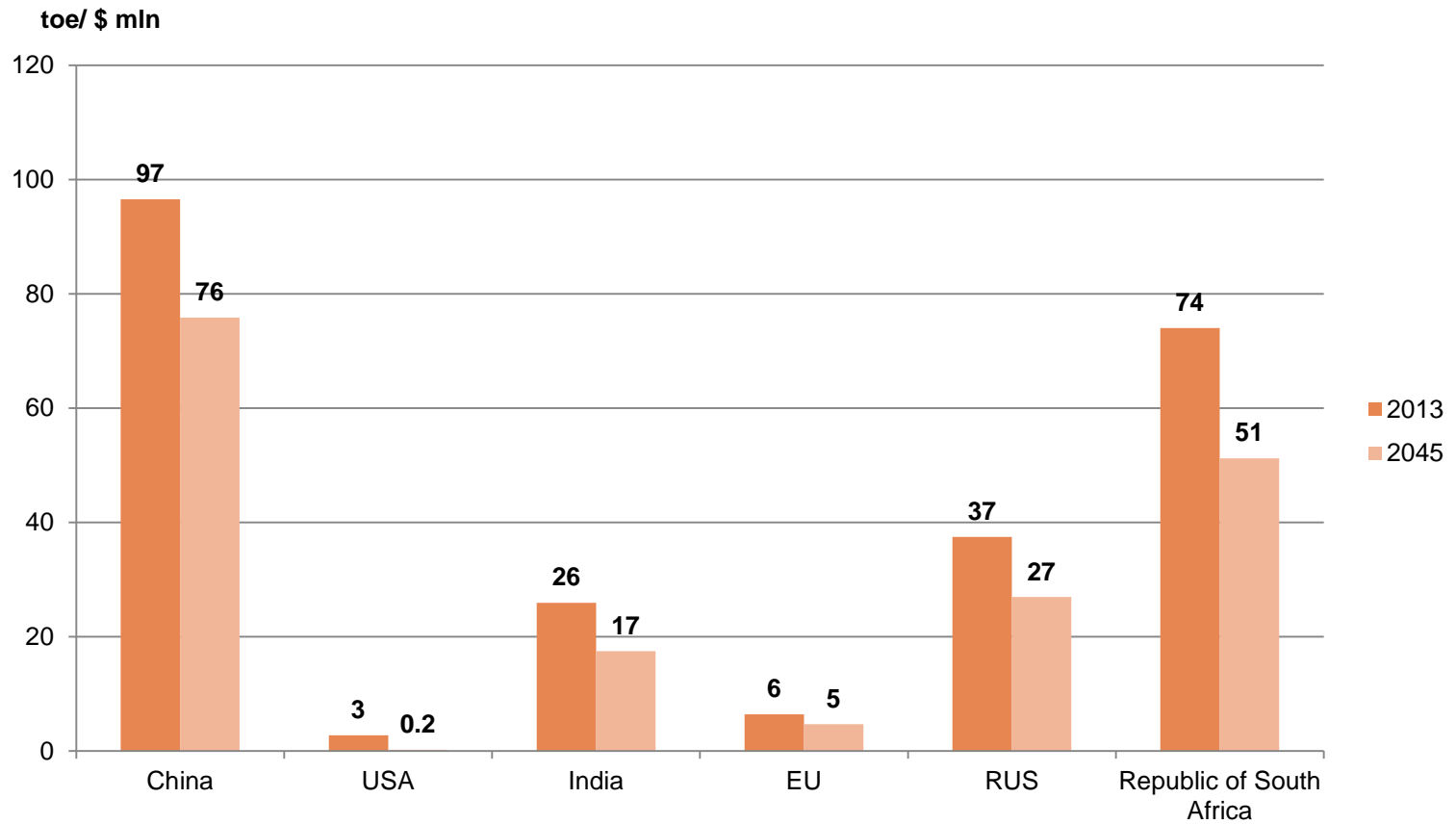


Share of electricity produced from coal

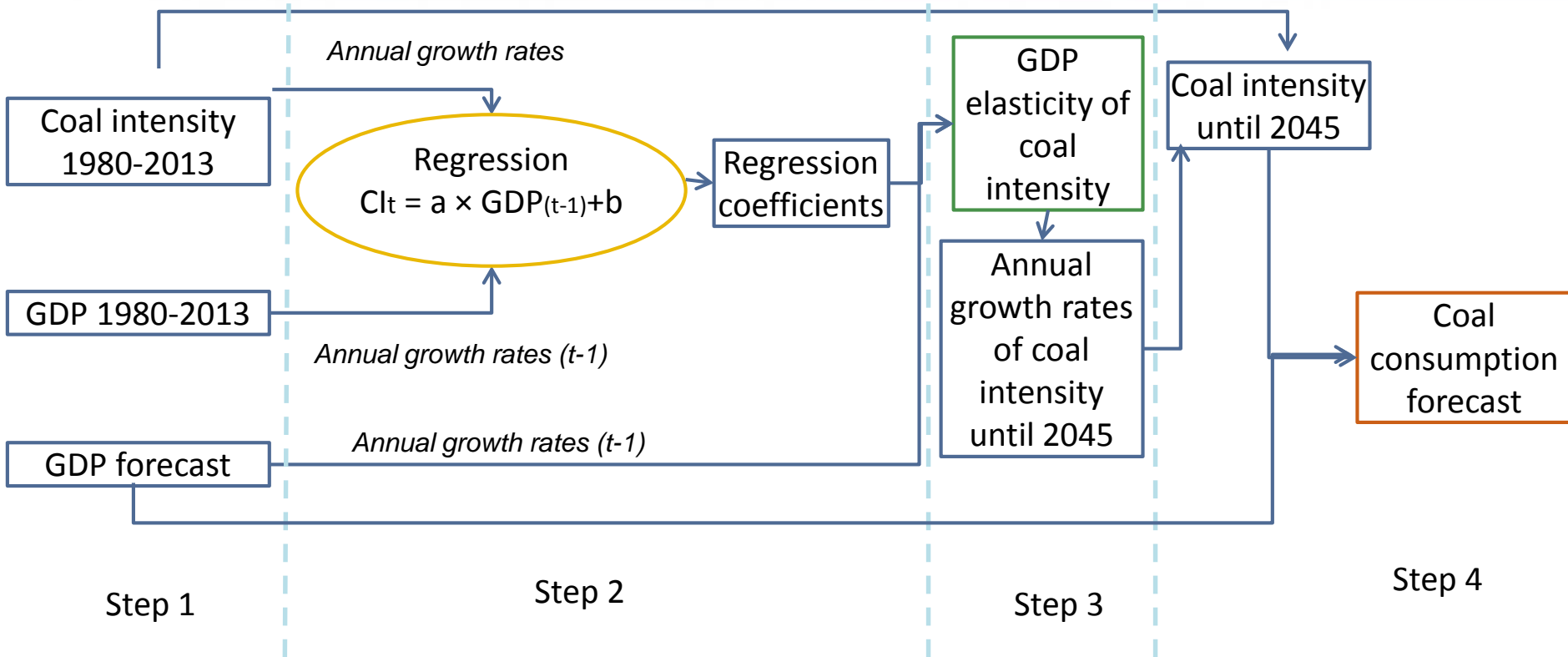




Other's sector unit coal consumption



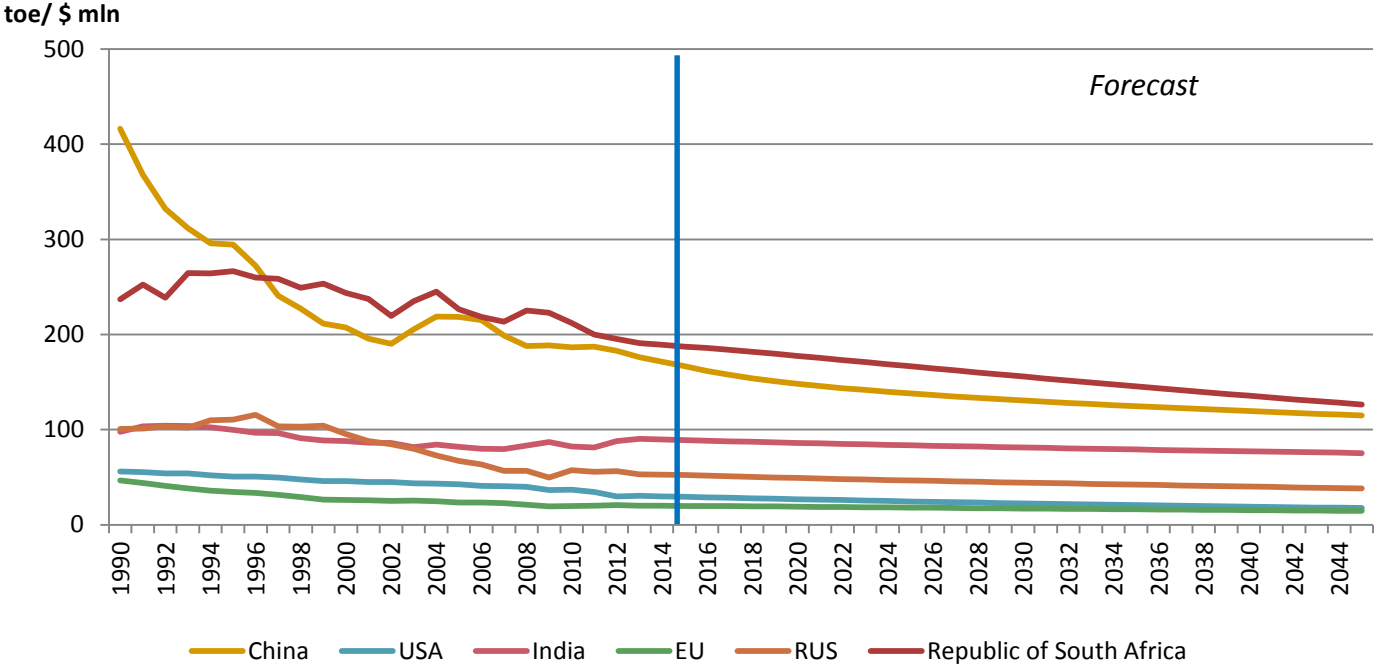
2. The coal intensity calculation: methodology



- 4-step methodology: preparing data, regression, calculation of annual growth rates, calculation of coal forecast
- Possible difficulties/restraints/problems: different amount of factual data for different countries



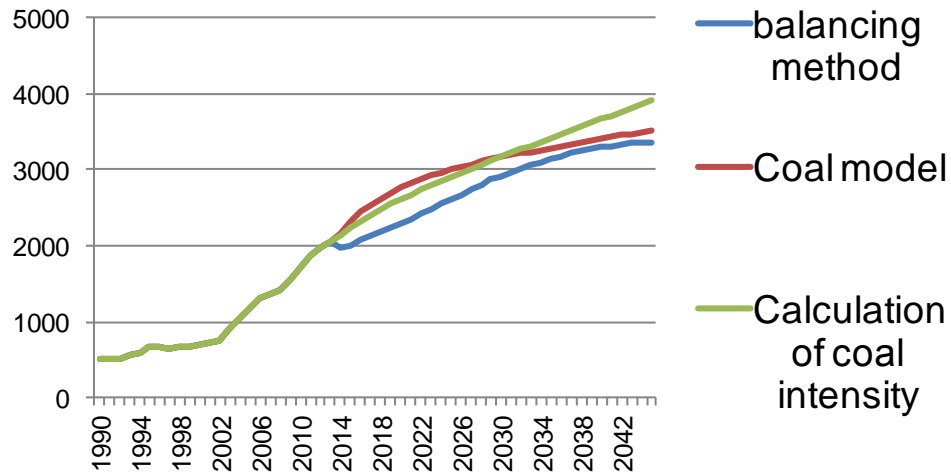
Coal intensity: forecast



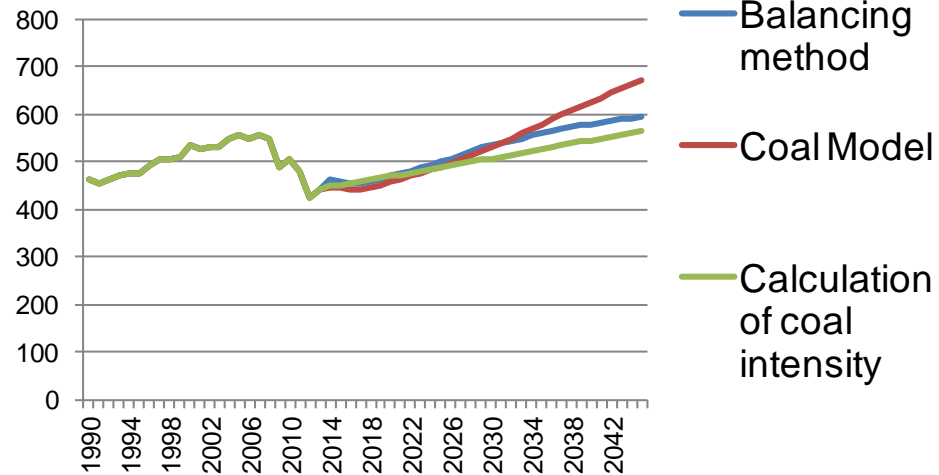
Coal consumption, mln toe: forecast



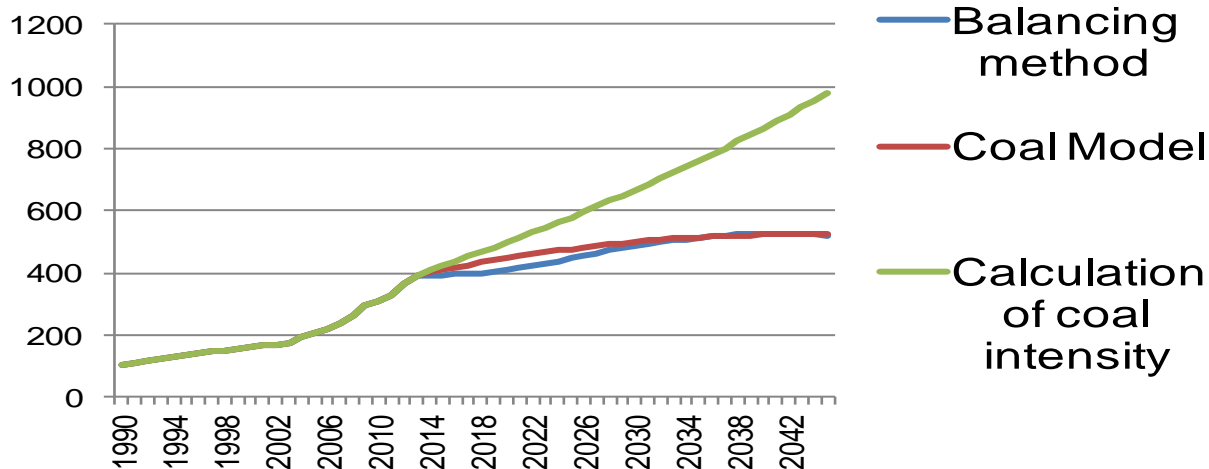
China



USA



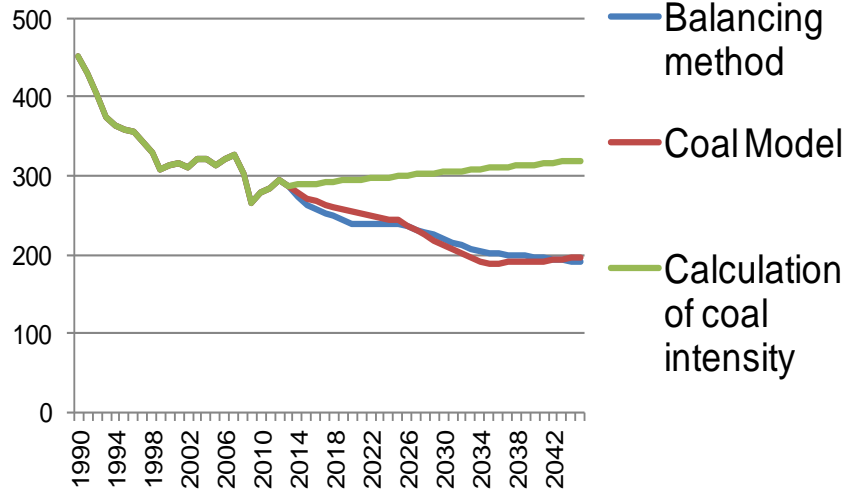
India



Coal consumption, mln toe: forecast



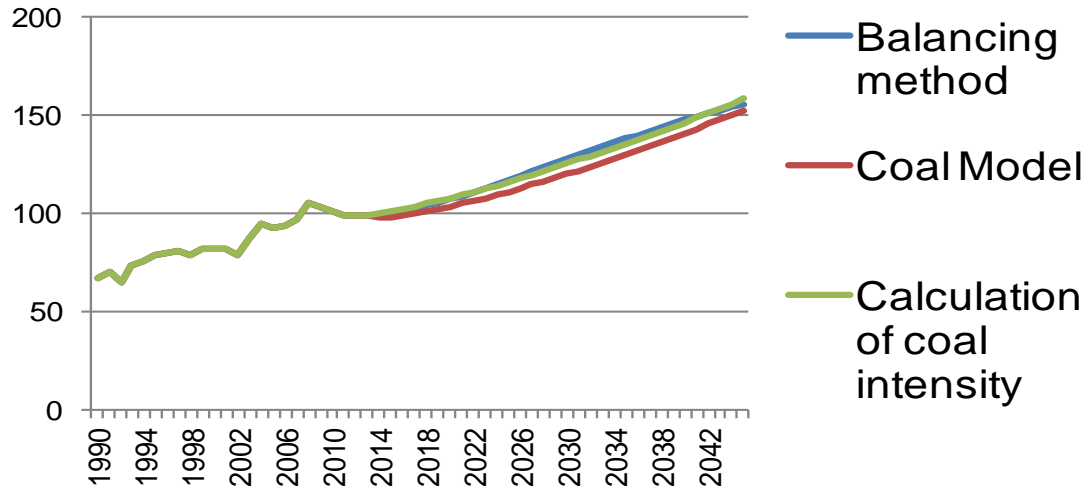
EU



RUS



South Africa





Thank you for your attention!