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ROLE OF KAZAKHSTAN IN ENERGY SECURITY OF THE REGION

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NATURAL GAS AND OIL PIPELINES

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Overview of the Caspian region

Indicators	KZK 	AZJ 	TKM 	UZB 	Casp Region	OECD	World
Population density (cap/sqkm)	6	111	11	69	--	36	13.5
Hydrocarbon rents, average (% GDP)	37	56	82	60	55	--	--
Energy consumption, 2011 (toe/cap)	4.7	1.4	4.8	1.6	2.7	2.9	1.9
CO2 emissions, 2011 (tco2/cap)	14	2.9	12	3.8	7.2	9.8	4.5
Carbon Intensity - CO2/GDP (kg CO2 / 2005 USD)	2.6	1.1	3.8	4.4	2.7	0.31	0.58

1) Kazakhstan – coal based energy system
2) Caspian region is dependent on export of hydrocarbons
3) Technological Stock is outdated
4) Next 10-15 years opens a window of opportunities

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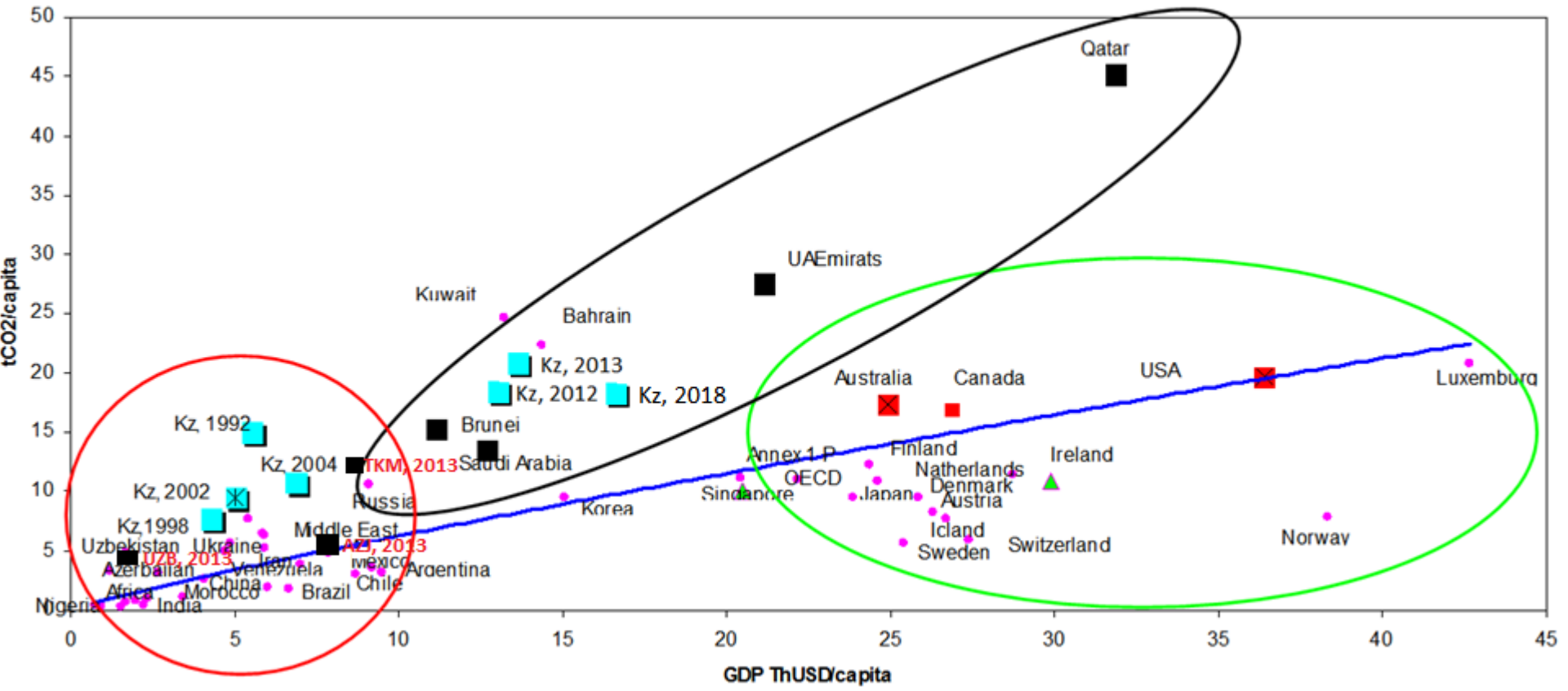
WORLD COMPETITIVENESS



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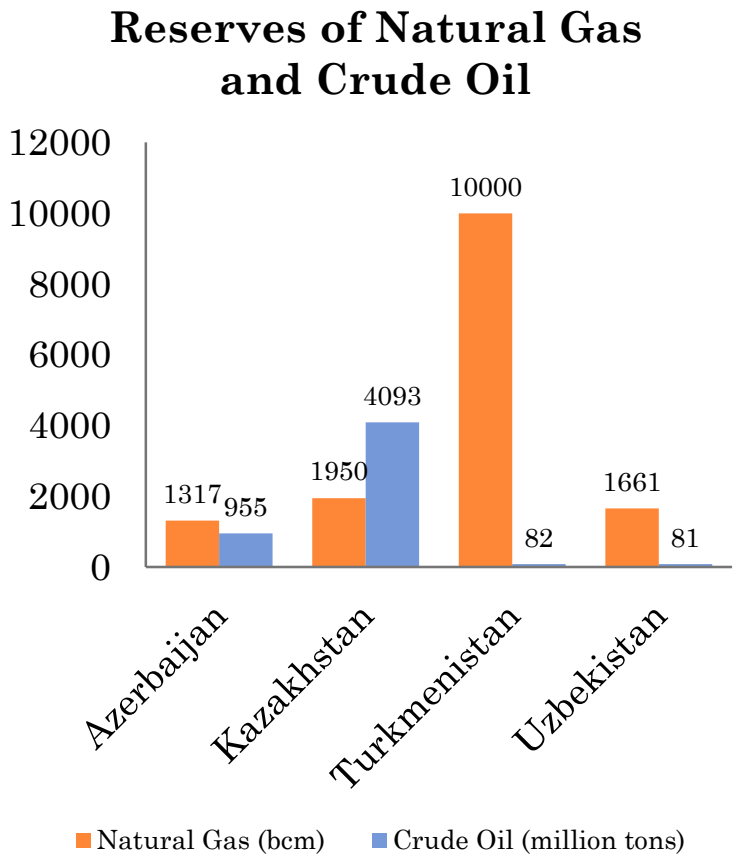
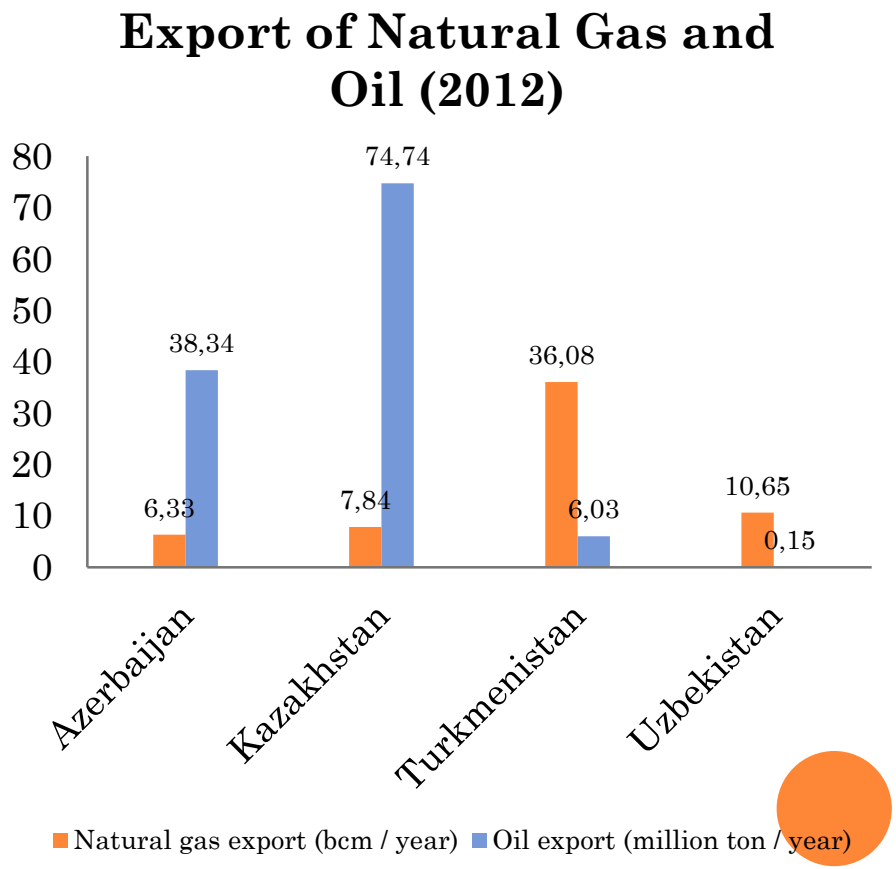
CASPIAN REGION RESERVES & EXPORT LEVELS

Central Asian Countries, CAC – abundant energy resources:

Azerbaijan – oil;
Kazakhstan - oil, and uranium;
Uzbekistan and Turkmenistan - natural gas





Source: O&G – World Oil and Gas Review 2013

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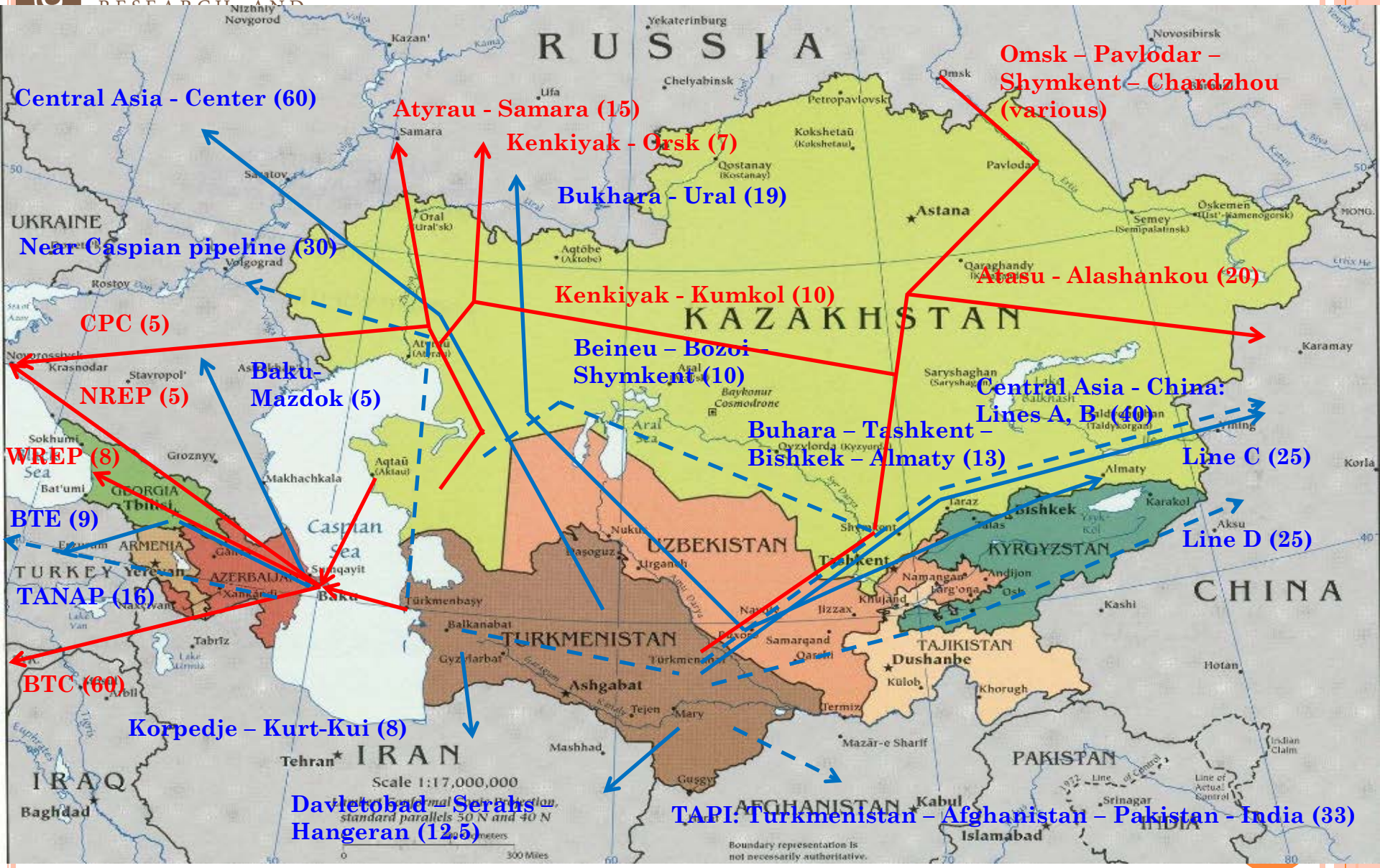

Existing Gas Pipelines

Planned Gas Pipelines

Existing Oil Pipelines

Capacity of pipelines: natural gas in billion cubic meters (bcm), oil in million tons (Mt)

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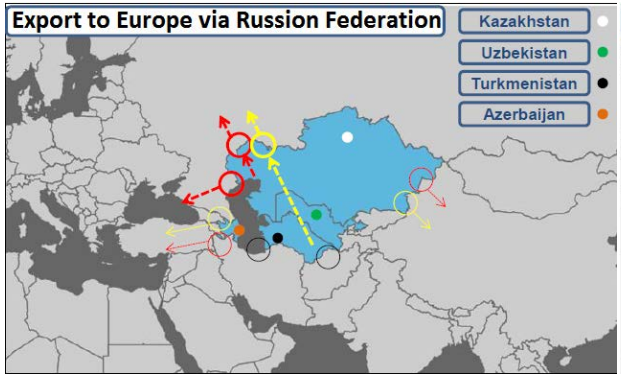
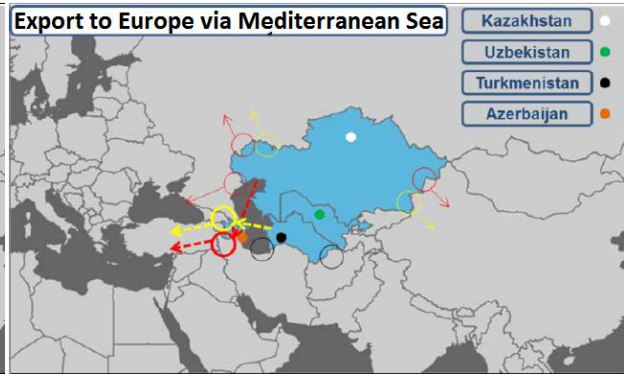
SYNERGY OF REGIONAL EXPORT POTENTIAL

1) Quantitative economical assessment of synergy potential of region:
   - amount of export;
   - directions of export;
   - climate change mitigation commitments (of Kazakhstan)
2) Economic losses from non-cooperation
3) Support for decision-making in infrastructural investments





Additional amounts of export in scenarios are:

Natural Gas – 42 bcm/year
Crude Oil – 50 Mtoe/year

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SYNERGY OF REGIONAL EXPORT POTENTIAL

- The efficiency (TFC/TPES) of the regional energy system could increase from 51% (in 2009) to 67% (in 2030) and this could lead to annual savings worth 10-15 billion USD for the whole region.

- The expected direct economic benefit of cooperation on export of hydrocarbons to Europe in 2020-2030 varies depending on studied export routes (1 – 2 billion USD annually via Russian direction, 7-10 billion USD annually via Mediterranean direction).

- Kazakhstan could keep its GHG emissions constant to the 2010 level of about 240 MtCO2eq till 2030 and save 4-5 billion USD annually for 2025-2030 in case of regional cooperation.

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New oil export options - Iran

Iran has developed extensive oil and gas infrastructure to take advantage of its open access to the ocean and rich energy resources, which are located mostly in South.

Over 80% of Iran's population resides in the North.

A North-South pipeline network diverts substantial volumes of crude oil from the Persian Gulf to refineries situated in the major industrial centers.

It would be far more profitable for Iran to export its high quality crude oil and meet internal demand with imported sour crude oil from Tengiz and Kashagan to satisfy demand in its major industrial and population centers in the North.

Since 1991 Kazakhstan has been exporting small quantities of Caspian crude (on average 20,000 bpd (about 1 Mt per year)) from Aktau to the port of Neka in Iran.

Through what is called a "swap" arrangement, Iran receives this oil in exchange for an equivalent volume which it delivers to Kazakhstan-chartered ships in the Gulf.

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SECURITY OF DEMAND - METODOLOGY

Aim of the study: test the CAC region, by the trade-off curves between an overall "risk" indicator and the cost, the quantities exported and the corresponding revenues.

Composite Risk Indicator calculated based on four components:

1. a geopolitical-socioeconomic risk (Worldwide Governance Indicators)
2. a market liquidity indicator
3. an estimate of the potential of local resources
4. a long-term environmental targets of the importers

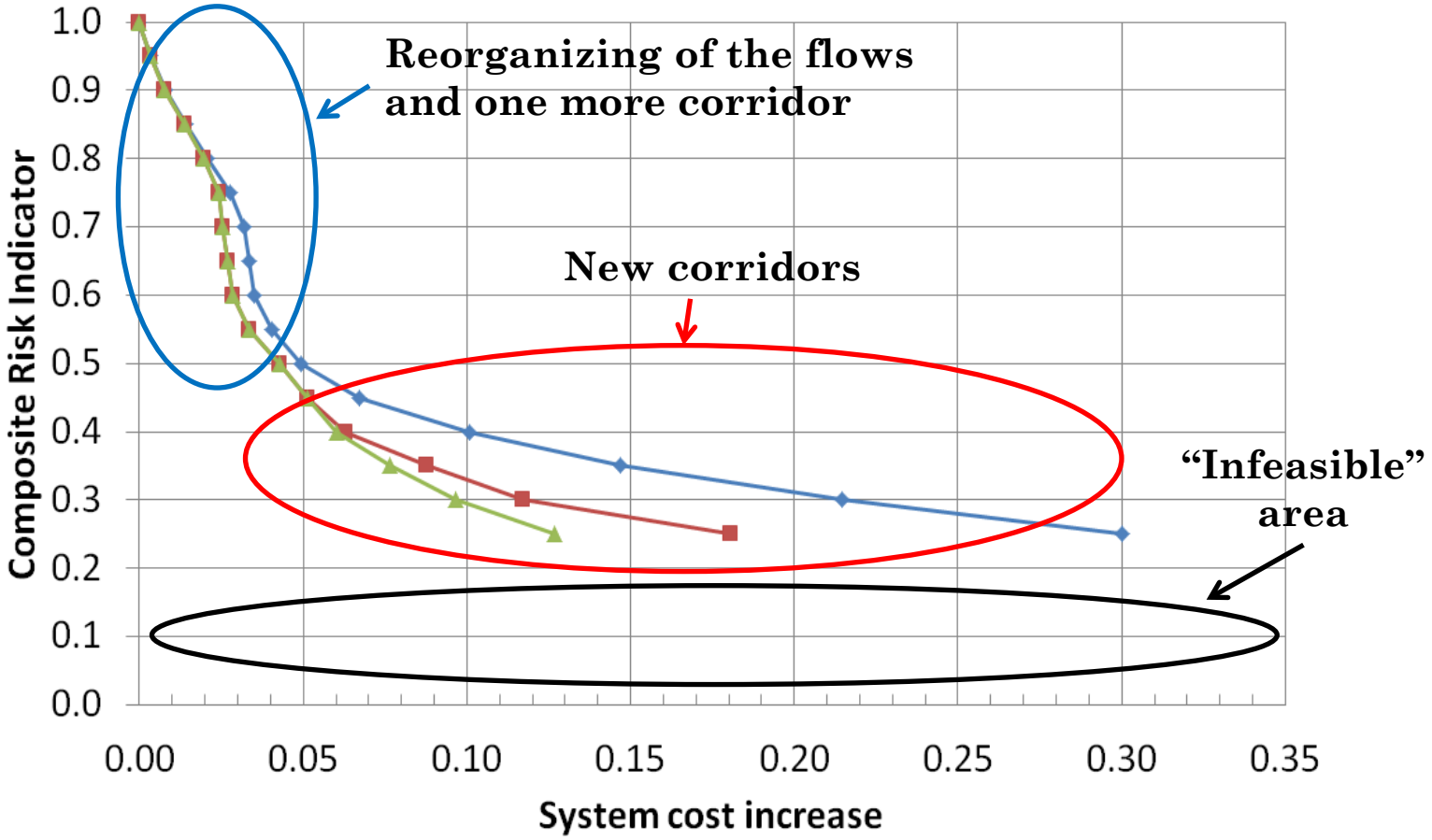
Revenue Control aims to have the three levels:

- Revenue 100% - the same level of revenue as in base case
- Revenue 90% - tolerance to 10% decrease from base case level
- Revenue 80% - tolerance to 20% decrease from base case level

Risk Indicator and Revenue Control applied to time period:

From 2015 till 2050

TRADE-OFF: RISK VS TOTAL SYSTEM COST



Trade-off curves under preparation:

- Risk vs Flow Volume
- Risk vs Revenue

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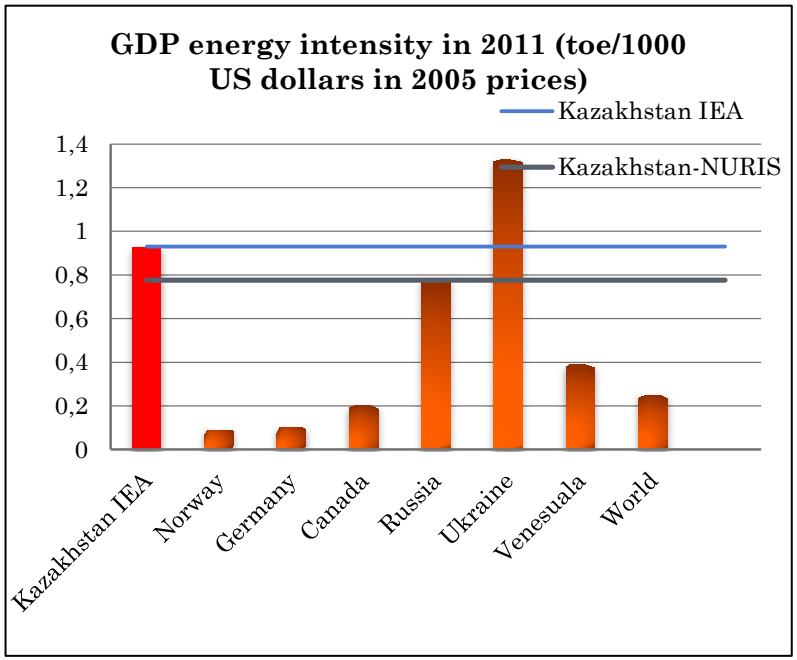
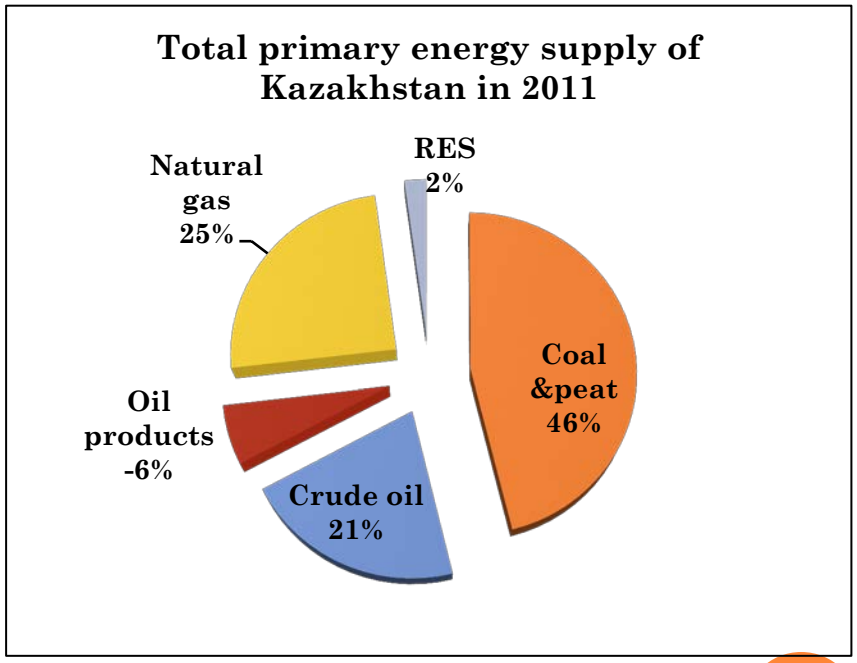
KAZAKHSTAN: WHERE ARE WE NOW?

- Kazakhstan takes **11th place in the world with its GDP energy intensity** after countries like Democratic Republic of Congo, Uzbekistan, Zimbabwe, Ukraine etc.
- **14th place in the world with CO_2 per capita**





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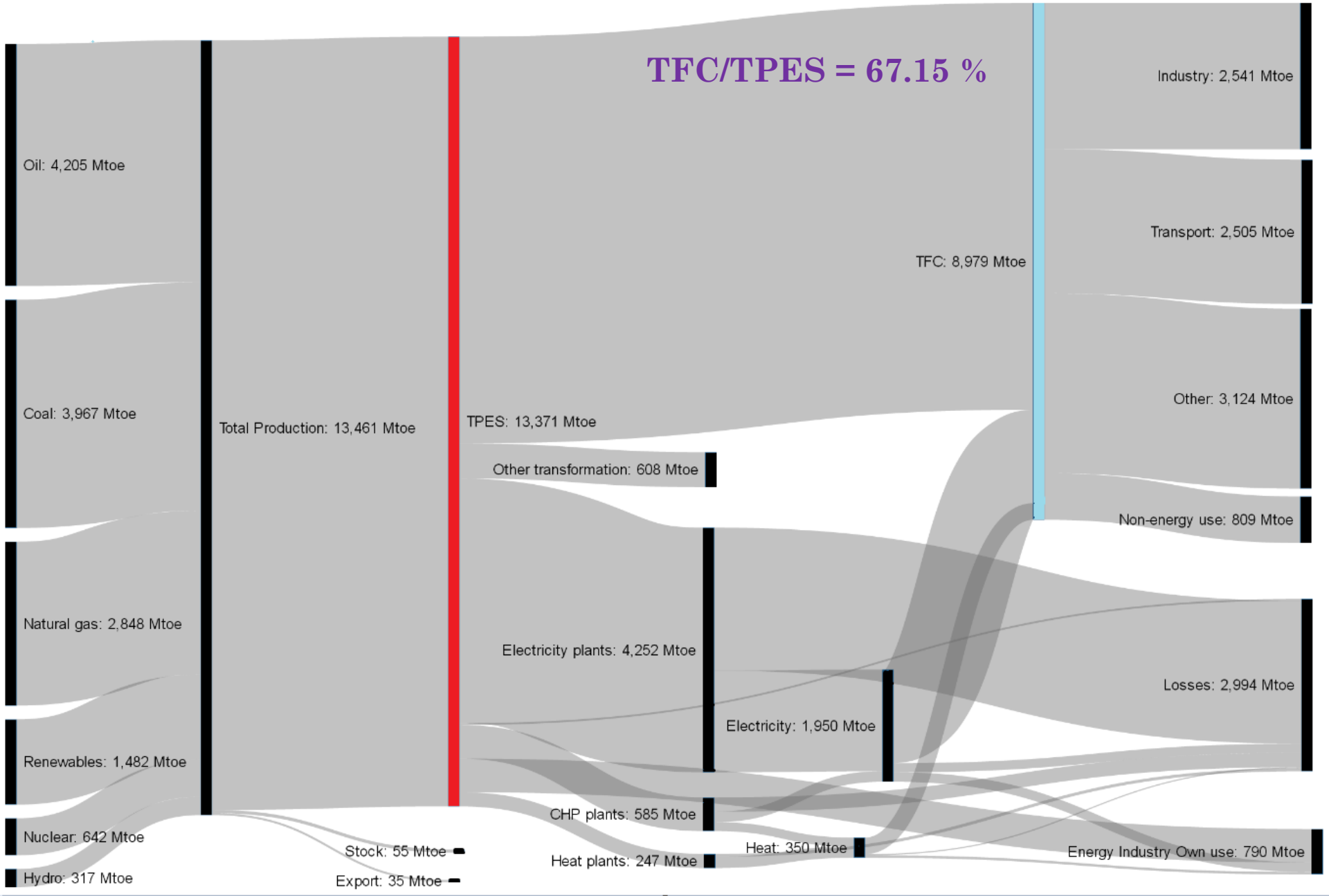
World energy balance



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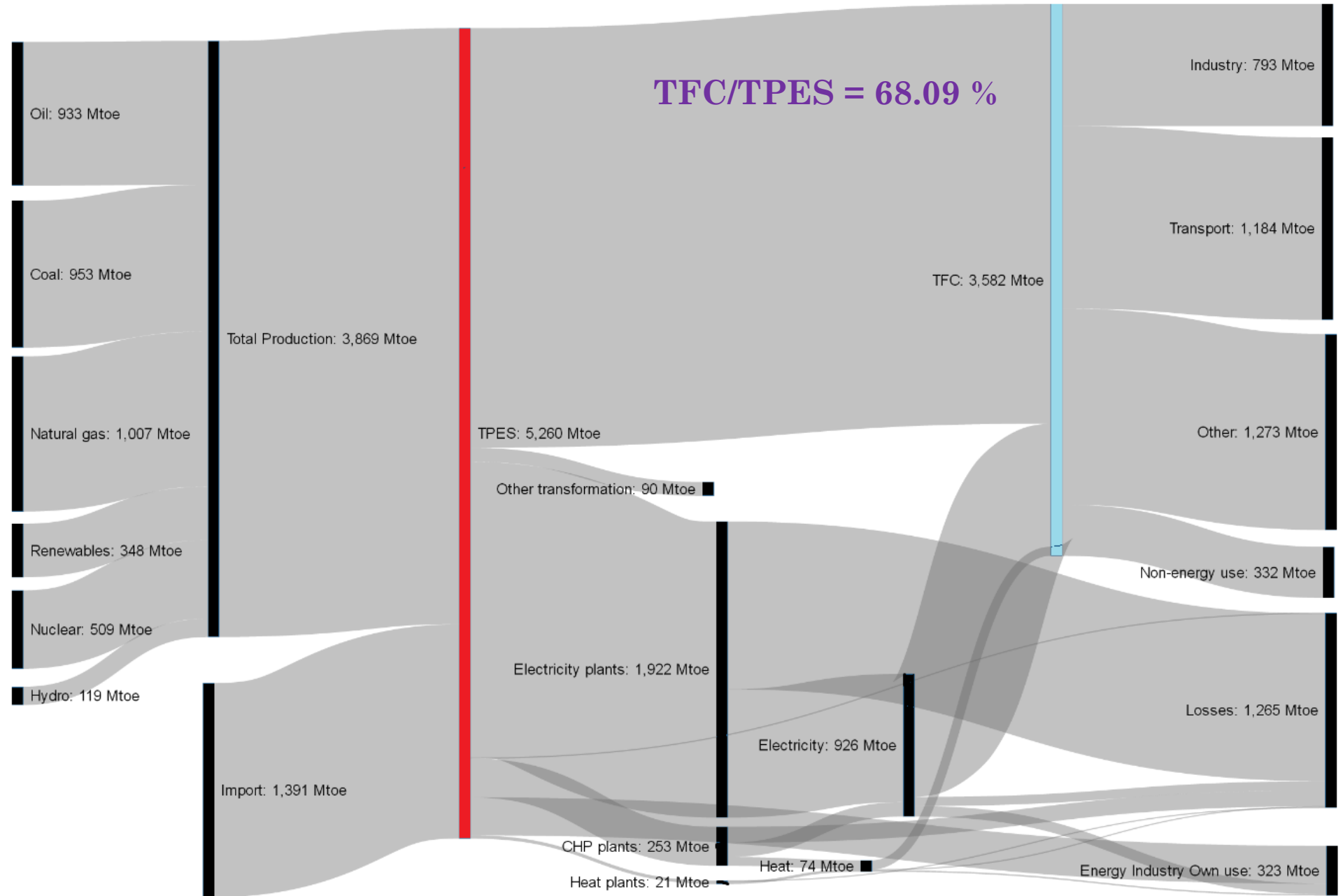
OECD ENERGY BALANCE



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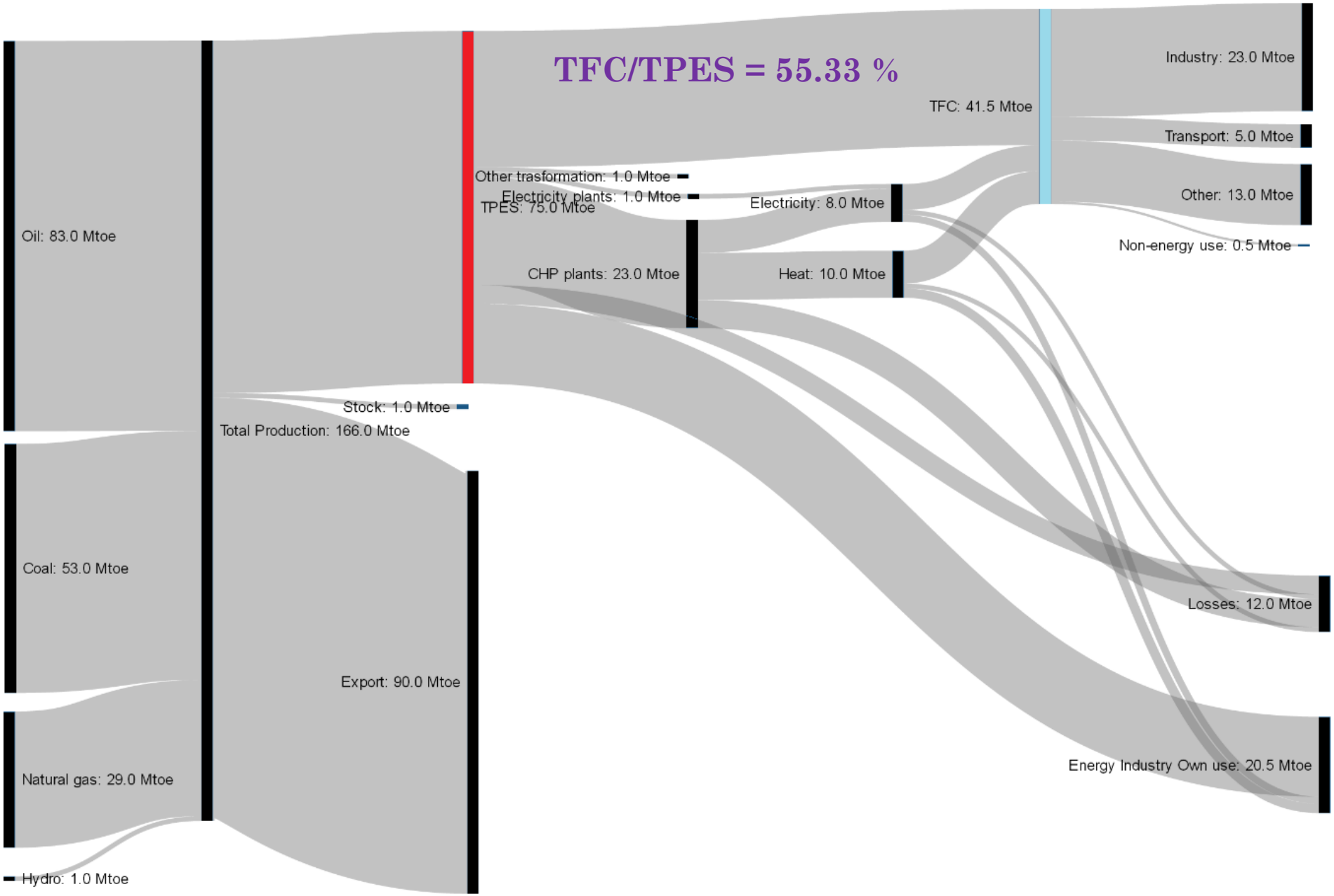
KAZAKHSTAN ENERGY BALANCE



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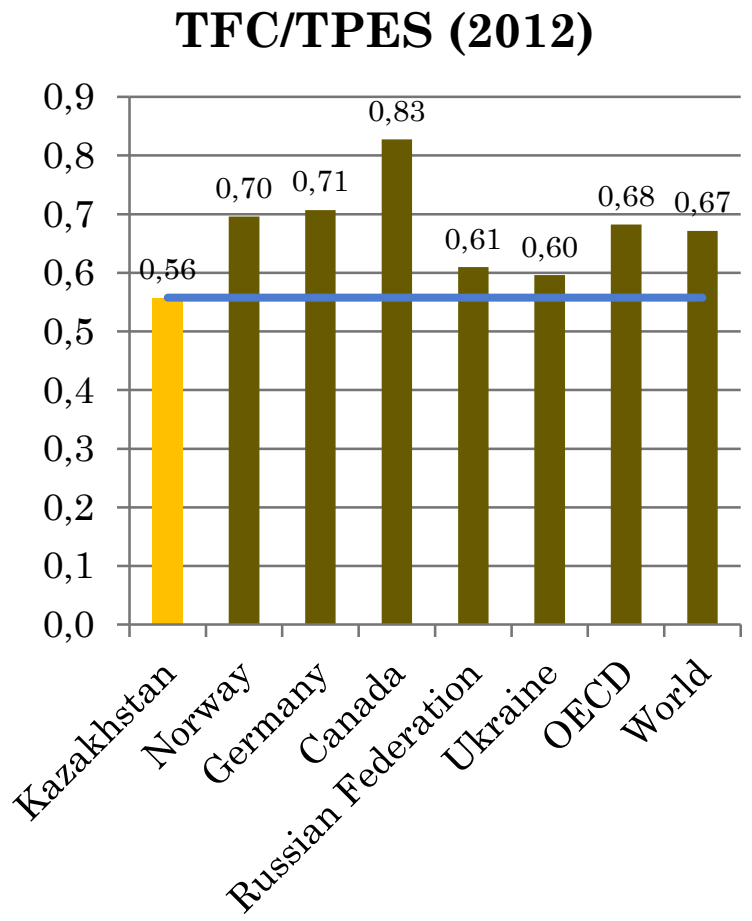
ENERGY EFFICIENCY POTENTIAL

Reasons of inefficiencies:

Geographical: the continental climate, large territory and low population density;
Administrative and economic: above normative losses, opaque energy statistics, lack of metering for energy saving, low profitability;
Technical: high wear of the equipment in the energy intensive sectors, high wear of electric lines, dilapidation of the housing stock.

Some significant cost-effective improvements can be gained even without a specific energy policy in case of reduction (elimination) of the market barriers (low priority of energy issues, incomplete markets for energy efficiency, distortionary fiscal and regulatory policies, insufficient, or inaccurate information).



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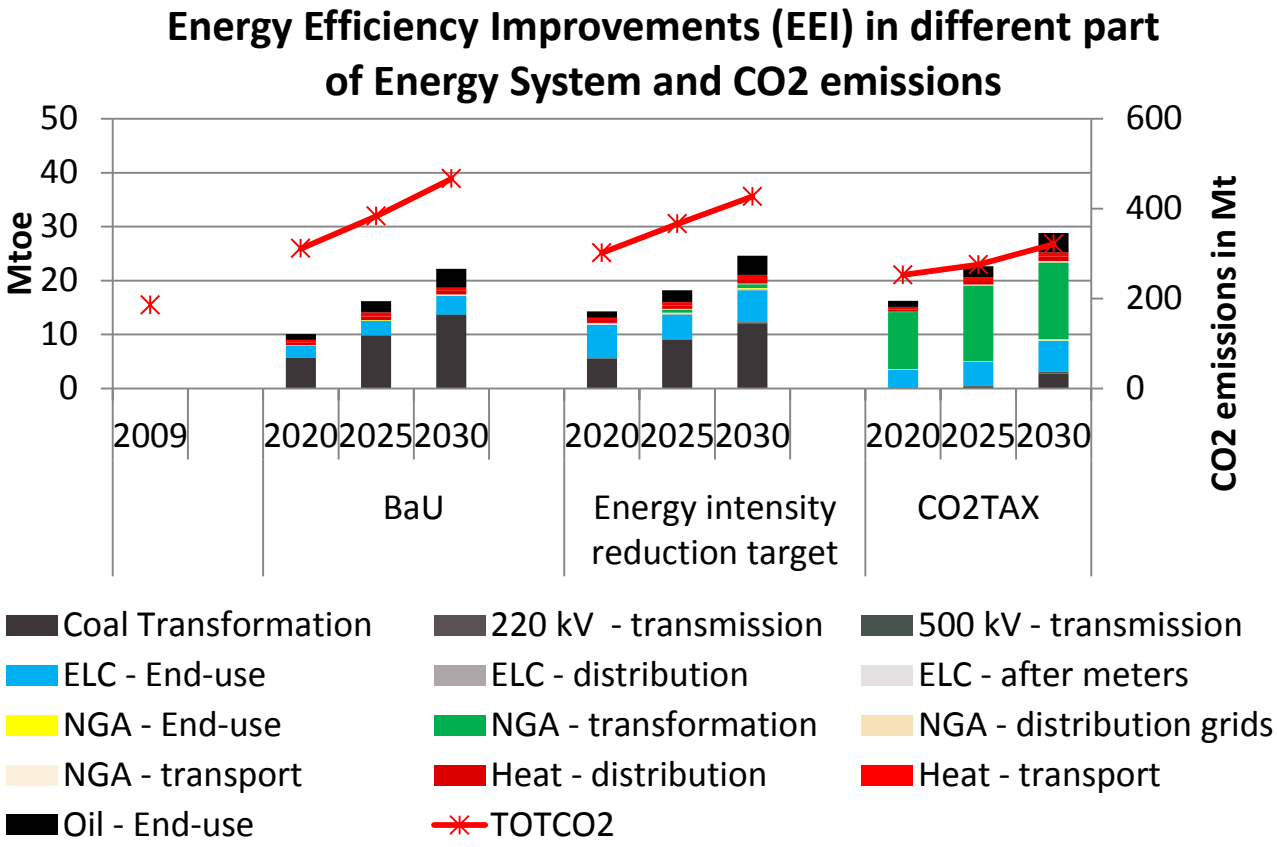
MODELING RESULTS – ENERGY EFFICIENCY

A.Kerimray, K. Baigarin, A. Bakdolotov, R. De Miglio and G.C. Tosato (2015), Potential Efficiency Improvement path in the Energy System of Kazakhstan , "Informing energy and climate policies using energy systems models", Springer Series "Energy Systems" (forthcoming)



- Even in BAU energy saving may reach 22Mtoe in 2030
- This scenario reduces GDP energy intensity by 18% by 2020 and by 40% by 2030 compared to the current levels.
- In BAU scenario CO2 emissions rise in average by 5% annually
- In CO2TAX by 3% annually

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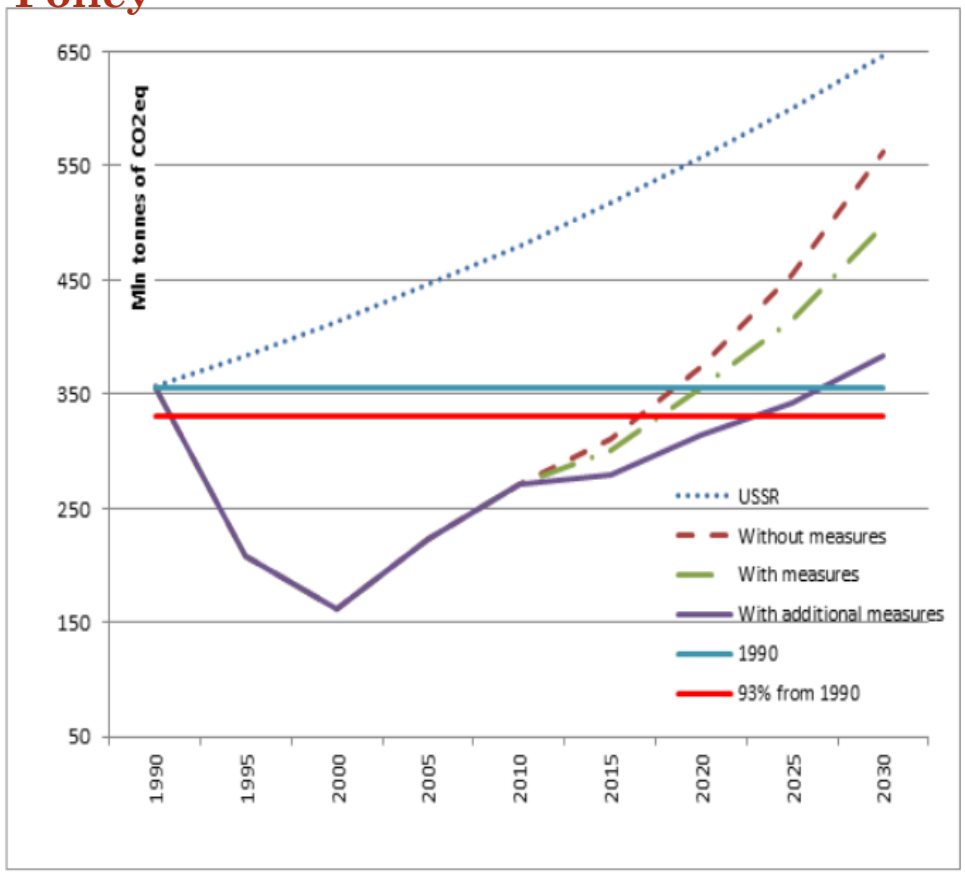
MODELING RESULTS – GHG EMISSIONS

III-VI National Communication of the Republic of Kazakhstan to the UN Framework (2013), Chapter 4.

A. Kerimray, K. Baigarin, G.C. Tosato, R. De Miglio (2015), «Climate Change mitigation scenarios and Policies & Measures: the case of Kazakhstan» Climate Policy



GHG emissions projection for Kazakhstan's National Communication to the UNFCCC

GHG inventory was replicated (including non-combustion emissions)

Four scenarios were considered (according to UNFCCC guidelines):

- Inertial scenario (Kazakhstan as a part of USSR)
- Without measures (inertial, frozen technology scenario)
- With measures (the least cost scenario)
- With additional measures (CO_2 penalty of 10-20$'2000ppp/t$CO_2$ in 2020-2030)

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Economic growth and climate change for Kazakhstan

Kazakhstan has necessary conditions for a successful transition to knowledge based economy over the next 30-50 years.

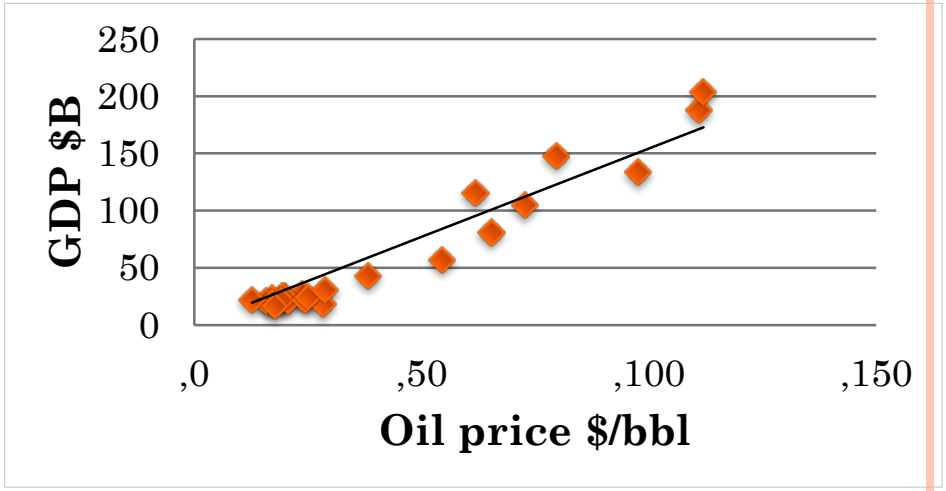
Accumulation of human capital is the most important precondition for a transition to knowledge based economy and can be fulfilled by mobilization of resource rent.

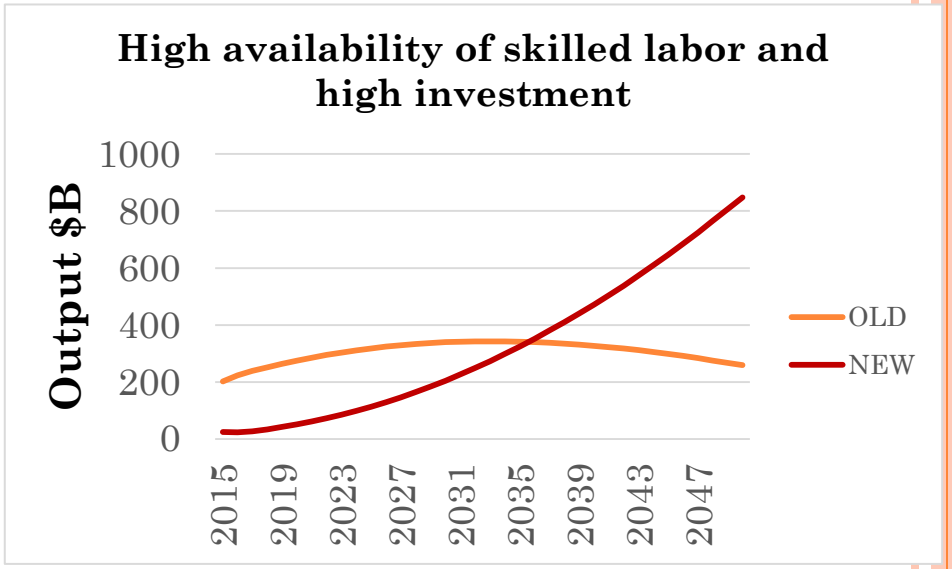
It is necessary to increase the share of highly skilled labor by rate of 6% per year.

To ensure the process of using the rent, there should be an effective system of redistribution of rent income.

Currently, a large part of the rental income goes abroad due to the fact that there is constantly decreasing return of investments from traditional structure of economy.

To increase the return of investments there is a need of the knowledge based economy.





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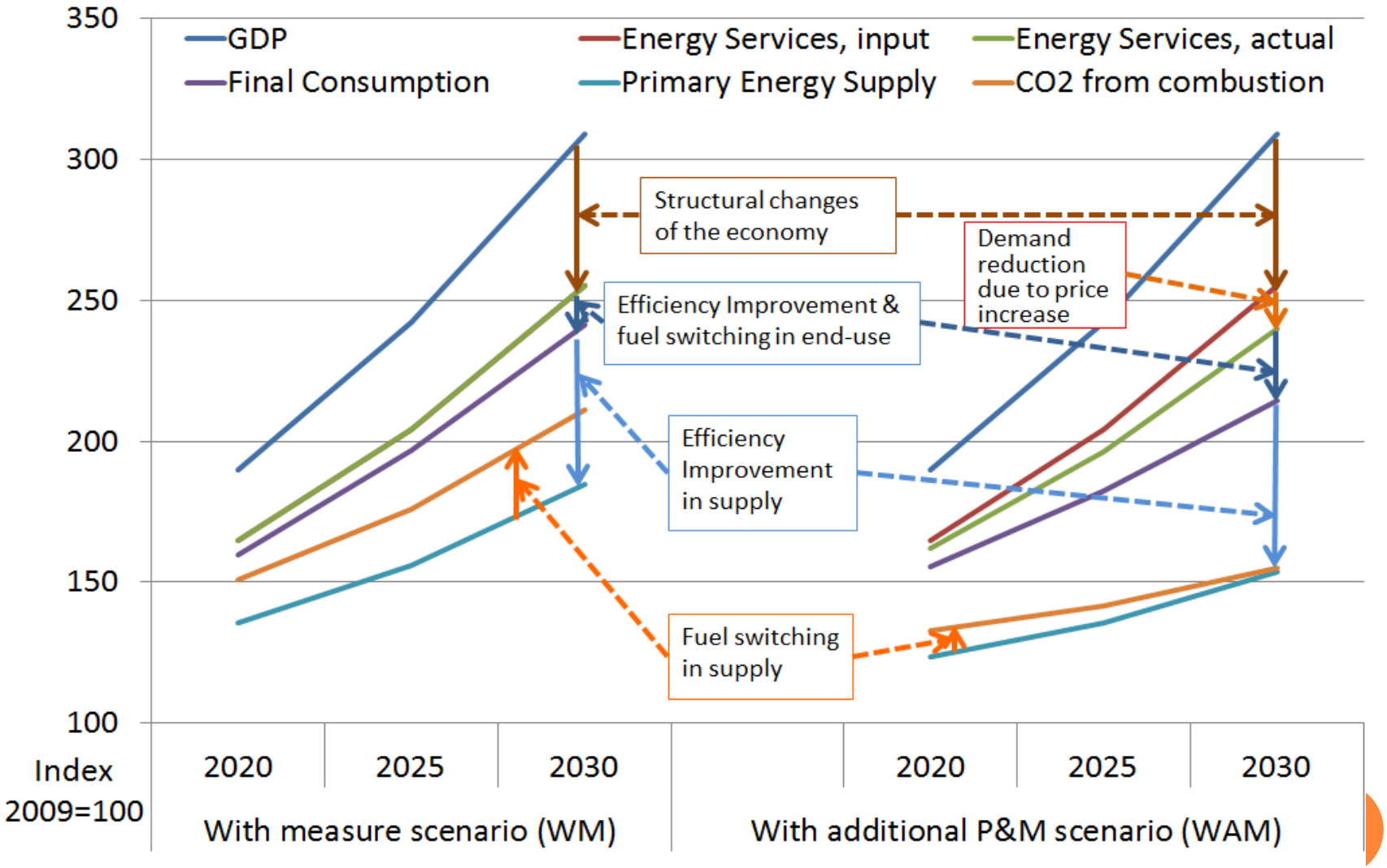
INFLUENCE OF POLICIES AND MEASURES ON GROWTH INDEXES



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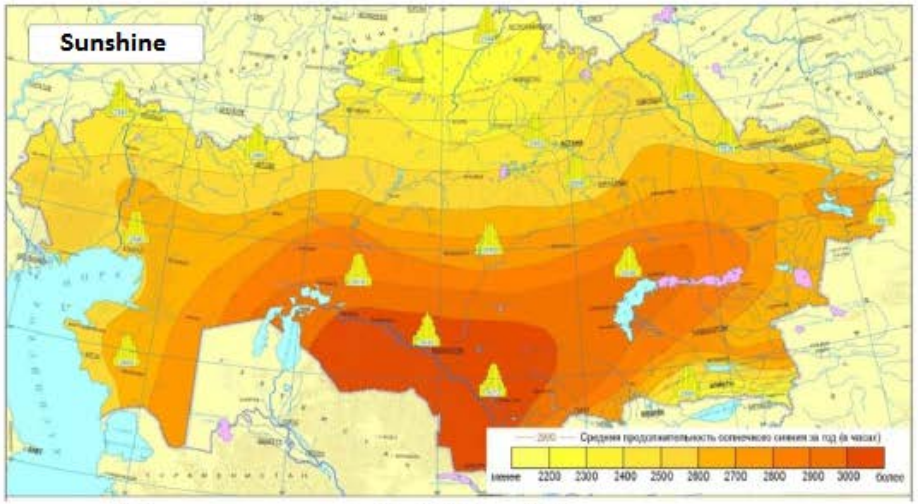
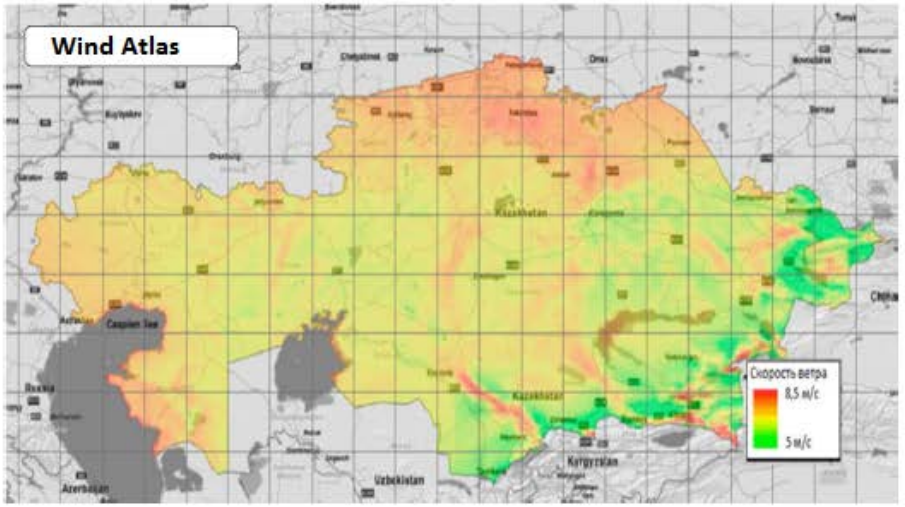
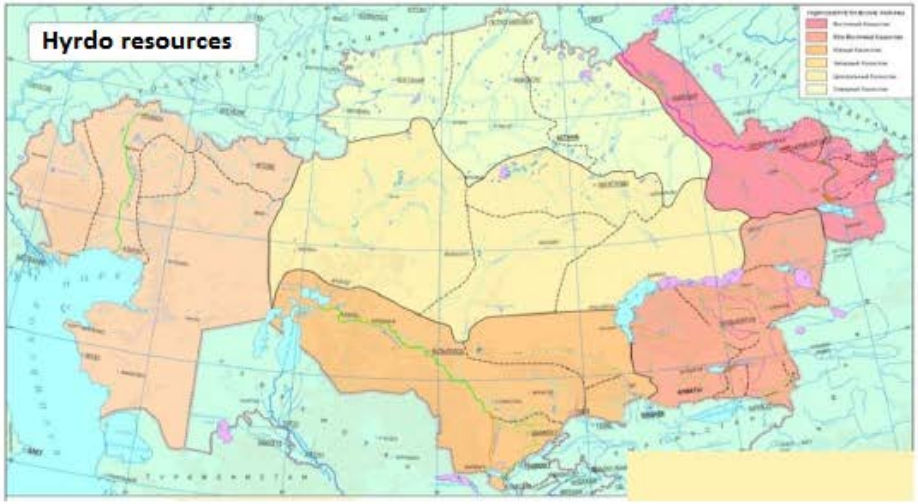
RENEWABLE POTENTIAL



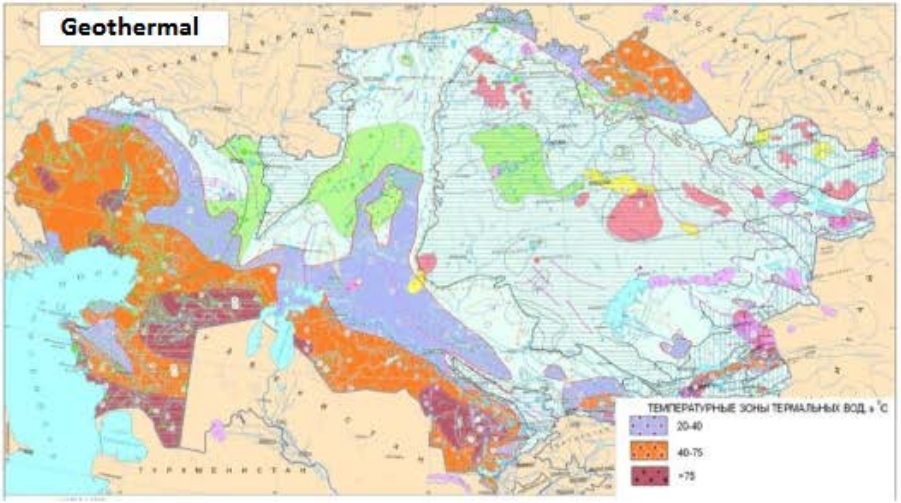
Solar energy potential is 2.5 billion kWh per year



Wind potential is 1820 billion kWh per year



Hydropotential of small rivers - 7.56 billion kWh per year



Geothermal potential is 4.3 GW

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RENEWABLES POTENTIAL

1) Kazakhstan is the first state of FSU introducing ETS
2) Legal basis for RES boost (feed-in tariffs)
3) Strategic turn toward Green Economy
   - Strategy "Kazakhstan – 2050"
   - Concept of transition to Green Economy
4) Regional Technological Network of Central Asian States (Green Bridge)
5) Program "Energy Saving 2020"

Target	2020	2030	2050
Energy intensity of GDP (2008 = 100%)	75%	70%	50%
Share of alternative sources of energy	Solar and Wind: ≥ 3% by 2020	30%	50%
CO2 emissions (2012 = 100%)	100%	85%	60%

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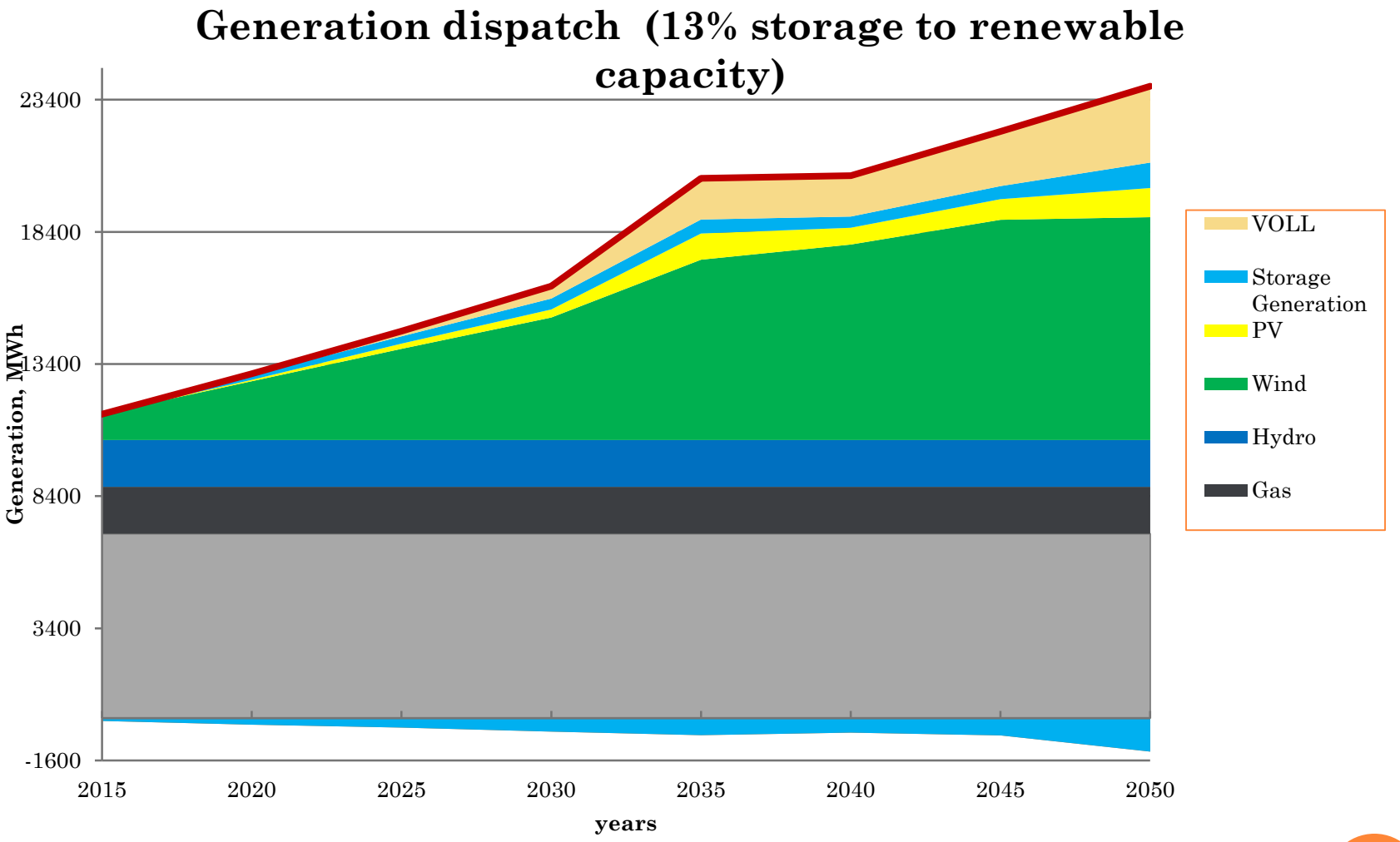
Modelleing of Renewables and Storage intergration



The optimal use of Renewables' potential with existing power network could be if Ratio of Storage capacity to Renewables capacity is around 13.5 %

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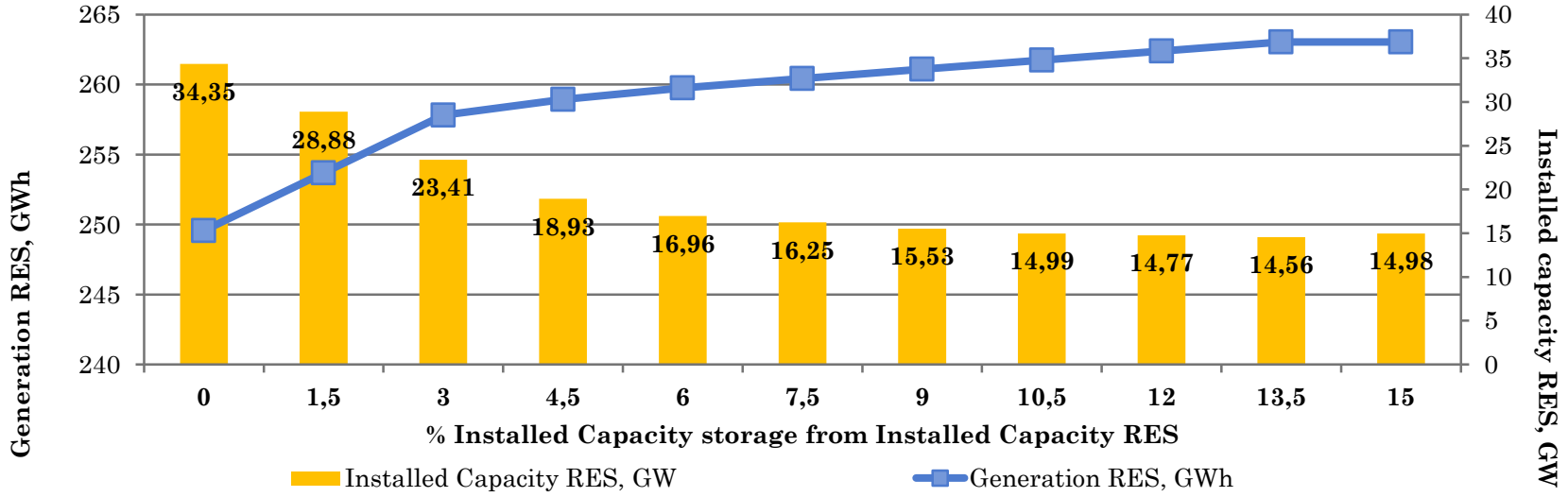
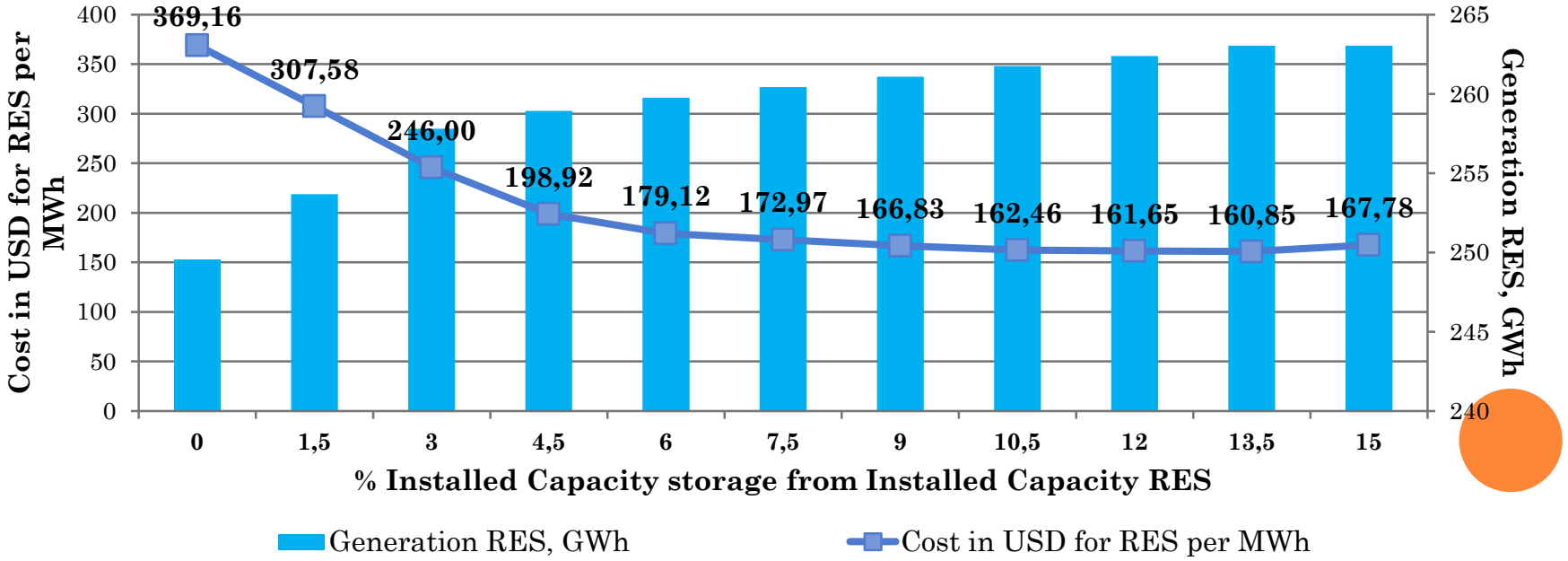
MODELLEING OF RENEWABLES AND STORAGE INTERGRATION





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METALL INTENSITY

The construction of one megawatt			
	power gas TPP	wind farm	Solar PV on silicon
Reinforced concrete (tons)	82	400	1100
Steel (tons)	58	130	170
Aluminum (tons)	0.26	3	35
Copper (tons)	0.26	1.15	4.5
Glass (tons)	-	-	69

Solar energy is required to produce a kilowatt-hour to 13.5 times more concrete, 17.3 times - copper and 135 times - aluminum, rather than thermal power plants.

EU today consumes 20% of the world metals while they are produced only 5%.

Oil and gas dependence is simply replaced by aluminum and copper dependence.