CO_2 storage capacity of Kazakhstan

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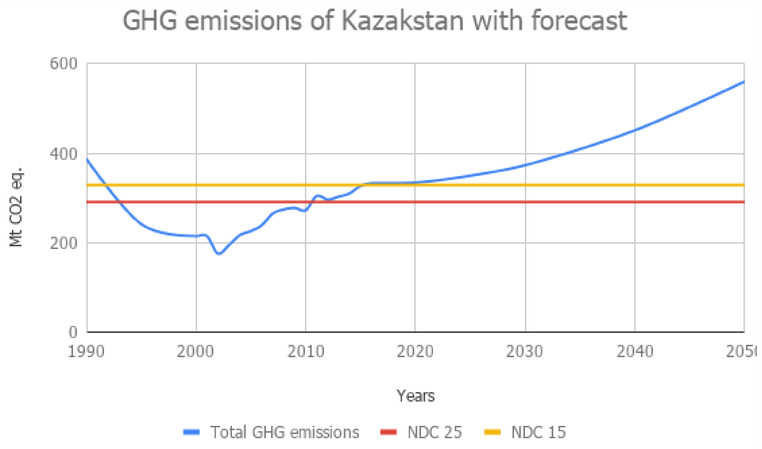
Introduction

Kazakhstan ratified Paris Agreement and country has to limit its Greenhouse Gas (GHG) emissions. The baseline year is 1990. Two targets for National Determined Contribution (NDC) exist:

- Conditional (**NDC25**) – 25% below baseline year (subject to international investments)
- Unconditional (**NDC15**) – 15% below baseline year

Kazakhstan's progress in NDCs:

- NDC25 limit was exceeded **in 2011**
- NDC15 limit was exceeded **in 2016**



- Coal accounts for **65%** of nation's net energy output
- **67%** of total GHG emissions correspond to stationary combustion points (power plants, cement factories, etc.)
- 225 stationary combustion facilities with > 20 000 t annual GHG emissions are registered in the country
- 104 of them are large emitters with > 100 000 t annual GHG emissions

Research Objectives

- To evaluate CO_2 storage potential in sedimentary basins of Kazakhstan
- To estimate effective CO_2 storage capacity in sedimentary basins of Kazakhstan
- To serve as a baseline for the future CCS activities in Kazakhstan

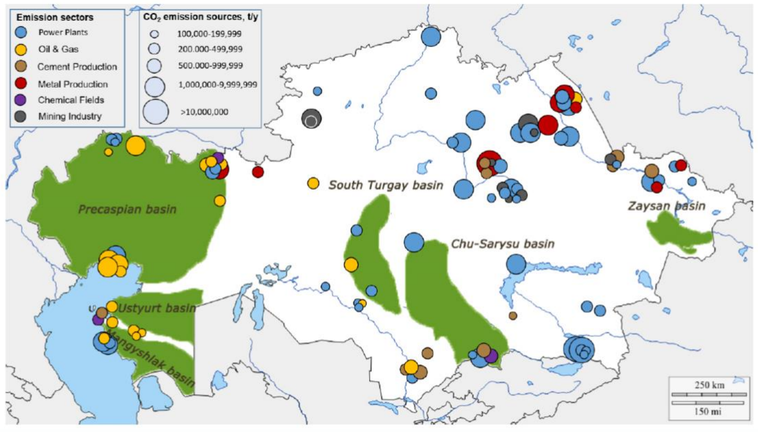
Methodology

Suitability of basins have been evaluated in terms of storage safety, storage capacity and feasibility:

- **Storage safety category:** Tectonic setting; Basin depth; Faulting intensity; Salts
- **Storage capacity category:** Size of the basin; Aquifers; Hydrocarbon potential; Geothermal regime; Coal reserves
- **Feasibility category:** Industrial maturity; On/offshore; Climate; Accessibility; Infrastructure; CO_2 sources

Qualitative features of the basins are transformed into quantitative values for suitability ranking

Suitability of basins



- Most suitable basins are in the western and central part of the country
- Major part of CO_2 emitters are far from potential storage sites, however still significant part of emitters resides in nearby area of potential storage sites

Sedimentary basin	Containment (23%)	Capacity (34%)	Feasibility (43%)	Overall suitability (100%)	Rank
Precaspian	0.77	0.84	0.85	0.83 (very good)	1
Mangyshlak	0.78	0.65	0.92	0.80 (very good)	2
South Torgay	0.78	0.49	0.92	0.74 (good)	3
Ustyurt	0.96	0.72	0.68	0.73 (good)	4
Chu-Sarysu	0.51	0.60	0.80	0.66 (moderate)	5
Zaysan	0.15	0.17	0.37	0.25 (poor)	6

- Precaspian, Mangyshlak, South Torgay and Ustyurt are the suitable basins for the geological CO_2 storage
- Selected 4 basins have no severe faulting, well-sealed, sufficient capacity and existing infrastructure

CO_2 storage capacity

The effective CO_2 storage capacity was estimated using:

- Carbon Sequestration Leadership (CSLF) formula for oil and gas reservoirs
- US DOE formula for saline aquifers

Sedimentary basin	Oil reservoirs capacity, Mt	Gas reservoirs capacity, Mt	Saline aquifer capacity, Mt
Precaspian	179.2	524	131,250
Mangyshlak	8.0	24	44,156
South Torgay	5.4	21	5,123
Ustyurt	8.7	20	125,063
Chu-Sarysu	0	15	96,768
Zaysan	2.3	6	94
Total	**203.6**	**610**	**402,691**

Precapian basin:

- Pre-salt carbonates and post-salt sediments (~132 Gt)

Mangyshlak basin:

- Low-Middle Jurassic sandstones are covered with high-quality regional seal (~44 Gt)

South Torgay basin:

- Jurassic grabens filled with sandstone sediments (~5 Gt)

Ustyurt basin:

- Jurassic-Triassic sections and sediments from the Buzachi region (~125 Gt)

Conclusion & Outlook

- Kazakhstan has a tremendous potential for CCS to achieve Paris Agreement goals
- Total CO_2 storage capacity in 4 selected basins is ~306 Gt or ~917 years of annual Kazakhstan's GHG emissions
- Basin-specific studies will be carried out in one of selected basins

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