Co-benefits of climate actions informed by the use of macroeconomic modelling of adaptation measures

Dana Yermolyonok | November 2022 | Sharm El Sheikh

Meeting of the Katowice Committee of Experts on the Impacts of the Implementation of Response Measures

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

Co-benefits and climate risks for planning response measures

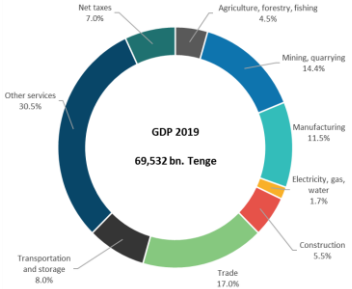
Key thesis:

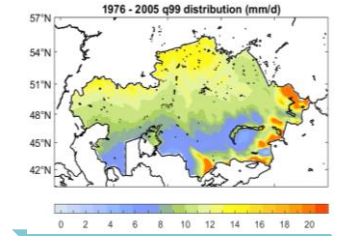
Design and implementation of **mitigation measures** is more efficient if **climate risks** and development **co-benefits** are taken into full account.

The "Climate Resilient Economic Development / CRED approach" enables partner countries in the economic quantification of these three dimensions (mitigation, climate risks, co-benefits) and provides a **quantitative & economic evidence base for informing integrated climate action.**

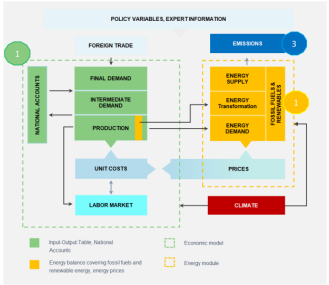
CRED approach: Macroeconomic modelling for evidence-based policy making

- Collect economic data
- Collect climate data

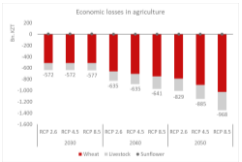




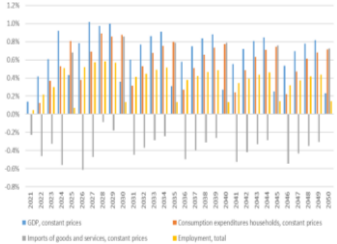
- Set up country-specific macro-economic model



- Select sectors
- Select climate hazards
- Make assumptions on frequency and intensity weather events
- Estimate damage costs
- Model adaptation options



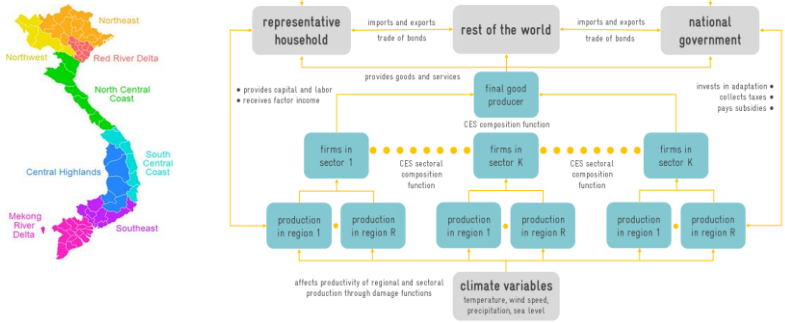
- GDP effects
- Employment effects
- Individual effects
- Direct and indirect effects



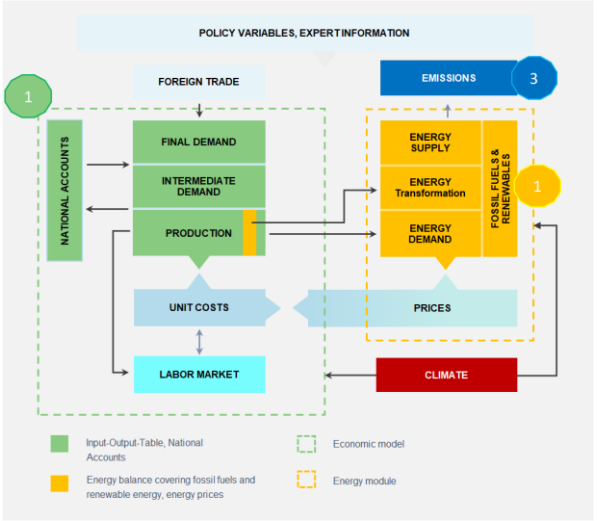
- Feed results into policy process and stakeholder discussions
- Further analyse and rank adaptation options
- Discuss financing options

Data → **Model** → **Scenario Analysis** → **Results** → **Recommen-dations**

CRED Macroeconomic Models



Vietnam: Dynamic General Equilibrium (DGE) Framework – DGE-CRED

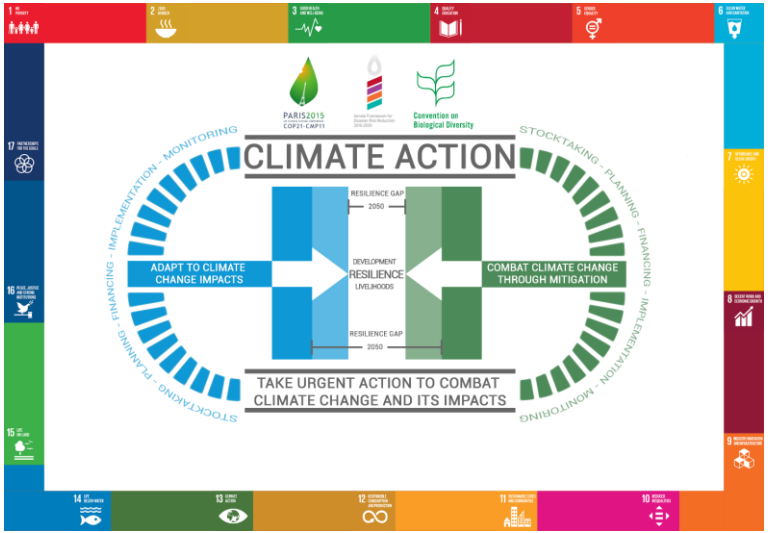


Kazakhstan & Georgia: Dynamic Input-Output models e3.kz and e3.ge

Integrated Climate Action: Kazakhstan‘s Low Emission Development Strategy

Linking adaptation and mitigation in the LEDS

- Soft-linking of economic models
- Reflecting synergies and trade offs in the LEDS narrative
- Promoting the shift from ‘co-benefit’ to ‘multi-benefit’ approach



Benefits

- Better climate action to reduce risks of maladaptation, ineffective mitigation measures and stranded assets
- Better understanding of the controversial causal relationship between ambitious international climate policy and its impact on Kazakhstan
- Supports consensus building in a ‘win-lose’ country and understanding needs for new business models

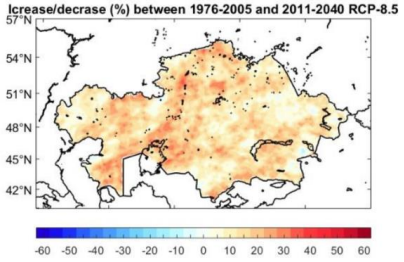
Economic data collected: Heat wave impacts in Kazakhstan

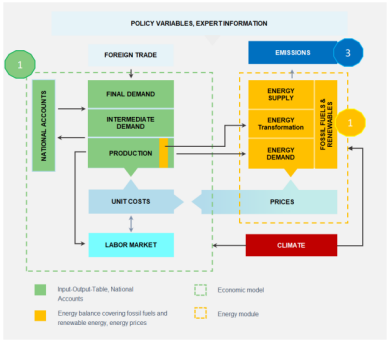
Sector	Impact	Source
	Increased government expenditures for health care services due to heat stress (+0.3%)	Own assumption based on estimations for Germany (Hübler 2014)
	Increased demand for beverages due to heat (+3%)	Own assumption based on Mirasgedis et al. 2014 and experiences in Germany during a heat wave in 2018
	Higher electricity demand for cooling (+6%)	Own assumption based on experiences in Germany
	Decreased hydro power production due to lower water levels caused by higher evaporation (-20%)	IEA energy balance 1998
	Reduced thermoelectric power potential due to insufficient cooling (-4%)	Van Vliet et al. 2016
	Wheat yield losses due to water scarcity (457 bn. KZT until 2030, 608 bn. KZT until 2050)	UNDP, 2020
	Increased sunflower yields (1,8 bn. KZT until 2030, 0,9 bn. KZT until 2050)	UNDP, 2020
	Decline in livestock production (109 bn. KZT until 2030, 170 bn. KZT until 2050))	UNDP, 2020
	Production losses due to less productive workers working outside (agriculture and construction)	Based on ILO 2019

Scenario Analysis | Step I: Economic impacts of climate change

Climate & Economic Data Step I

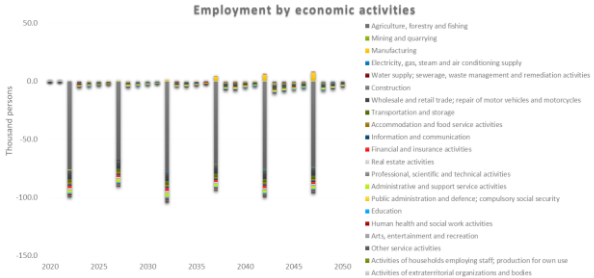
Assumption
heat waves increase from about 0.4 to max. 1.2 per year





GDP effect ↓ 1 %

Employment effect ↓ 1.1%

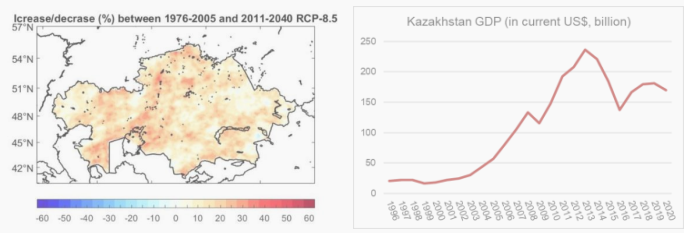


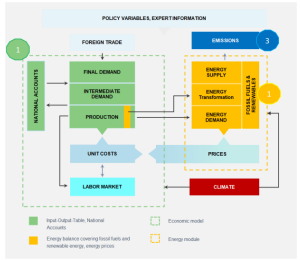
Example: *Heatwaves and deployment of wind power and energy efficiency improvements in the housing sector in Kazakhstan*

Scenario Analysis | Step II: Evaluation of adaptation measures

Climate & Economic Data
Step I

Assumption
heat waves increase from about 0.4 to max. 1.2 per year

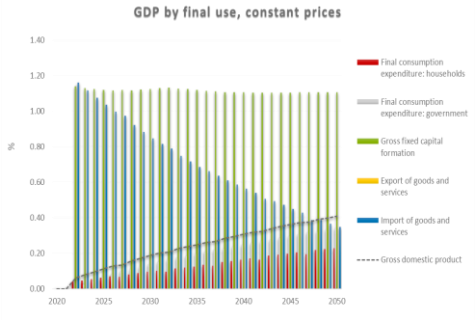




Investment ↑
Imports↑
Energy demand ↓
=
0.7% GDP ↑
0.35% Employment ↑
(35 000 add. jobs)

Adaptation Measures & Cost Benefit Analysis
Step II

Adaptation measures	Cumulated investment (2022 – 2050)	Adaptation benefits (by 2050)
Deployment of wind power	2.9 trillion KZT* (2.8 GW additional installed capacity at 2,472 USD / kW)	Preservation of power generating capacity during heat waves
Energy efficiency improvements in housing	Capacity factor: 36 % 8,831 GWh, 9 billion USD	Reduced energy demand by -11% for housing compared to BAU in 2050

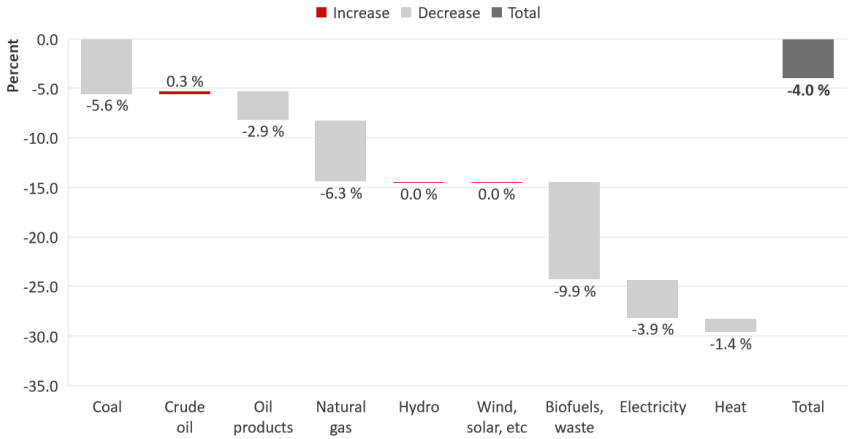


Source 1 IRENA., 2021; 2 World Bank, 2018b;

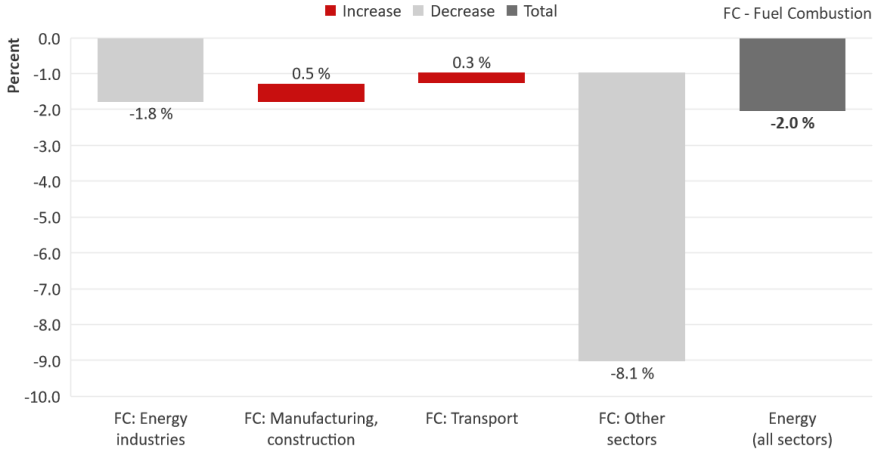
Scenario Analysis | Step II: Results for environmental indicators

Heat wave and deployment of wind power and energy efficiency improvements in the housing sector => CO2 emissions are rising slower than without mitigation measures

Energy balance: total final consumption (%) in 2047



CO2 emissions (%) in 2047



Benefits and challenges of macroeconomic modelling of adaptation measures

Benefits

- Mainstreaming climate adaptation into economic development agendas
- Complementing physical risk assessments
- Economy-wide cost-benefit analyses of adaptation measures
- Consistent framework for evaluating intersectoral relationships
- Facilitating inter-institutional exchange and dialogue
- Wide applicability
- Additional tool to assess the impacts of any other economic shocks (pandemic, war…)

Challenges

- Availability of data used as model inputs
- Quality of assumptions
- Requires time and experts' know-how

Use of CRED approach and the modelling results

Kazakhstan

- Integration of climate risks and adaptation into the LEDS
- E3.kz as a policy supporting tool for NDC road-map on adaptation planning

Georgia

- Application for the NAP processes
- Support in accessing climate finance for adaptation by using the modelling results
- Regular provision of updated modelling results to the National Bank

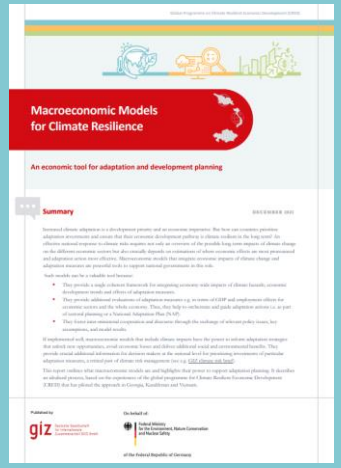
Vietnam

- Integration into the Green Growth Action Plan

CRED Publications/Knowledge products

Factsheet

Brief on Models



All knowledge products available on Project Website at giz: DE/EN

Dissemination | Overview of knowledge products

Climate hazard analyses Georgia and Kazakhstan

Model Handbooks Georgia, Kazakhstan and Vietnam

Global + National Modelling Reports

Climate Economic Modelling. A Practitioner's Guide

Preparation | **Modelling & evaluation** | **Implementation**

Factsheet

Project Brief: Managing Economic Risks of Climate Change

Sectoral Policy Briefs and Infographics in Georgia and Kazakhstan
GEO: Agriculture, Tourism & Infrastructure
KAZ: Agriculture, Energy, Infrastructure
VN: Overall Economy, Agriculture

Model Comparison Study

Brief on Macroeconomic Modelling for Climate Resilience

Country Policy Reports in Georgia, Kazakhstan and Vietnam

Contacts

Dana Yermolyonok
Senior National Advisor, Kazakhstan

+7 777 551 53 60
dana.yermolyonok@giz.de

Stefanie Springorum
Senior Project Manager, Berlin

+49 30 338424-769
stefanie.springorum@giz.de

Dr. Sebastian Homm
Senior Advisor, Eschborn

+49 6196 79-4284
sebastian.homm@giz.de

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