



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



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

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:

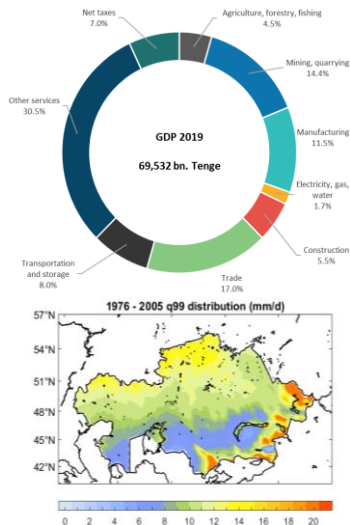
Design and implementation of **mitigation measures** is more efficient if **climate risks** and development **co-benefits** are taken into full account.

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**.

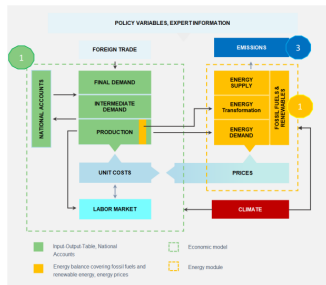


CRED approach: Macroeconomic modelling for evidence-based policy making

- Collect economic data
- Collect climate data



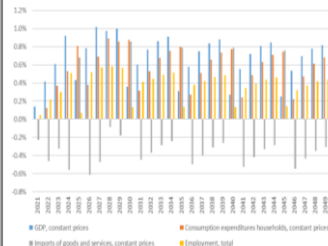
- Set up country-specific macro-economic model



- 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

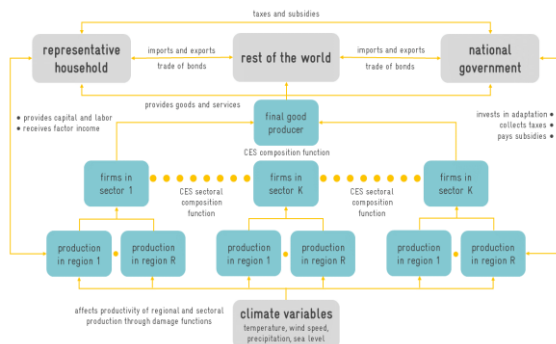


- Feed results into policy process and stakeholder discussions
- Further analyse and rank adaptation options
- Discuss financing options

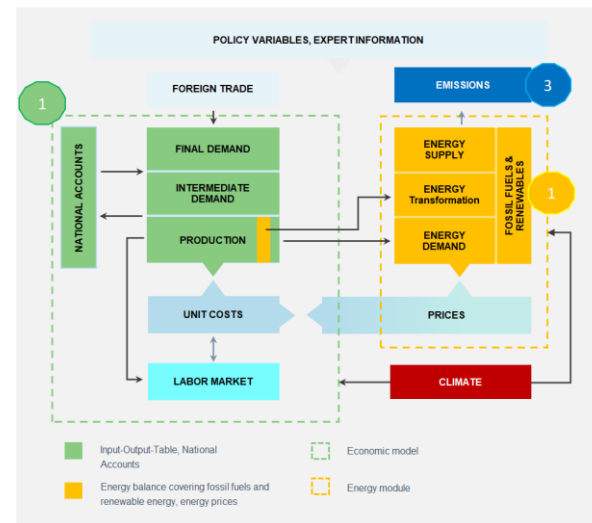




CRED Macroeconomic Models



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



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



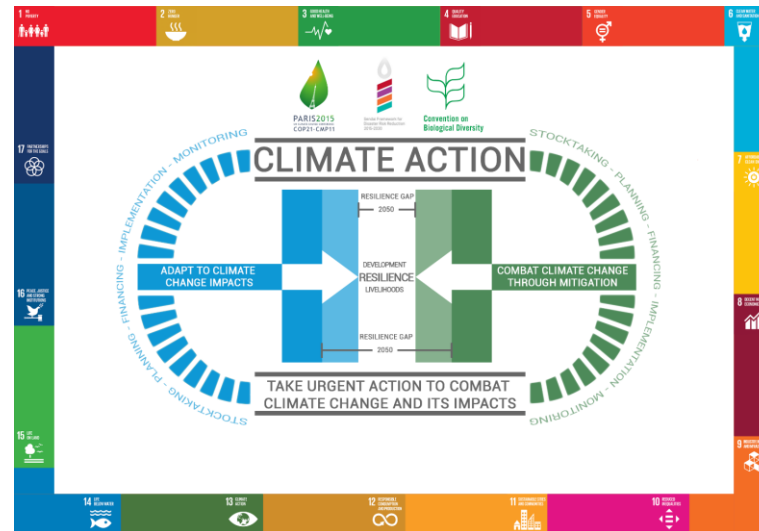
Integrated Climate Action: Kazakhstan's Low Emission Development Strategy

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

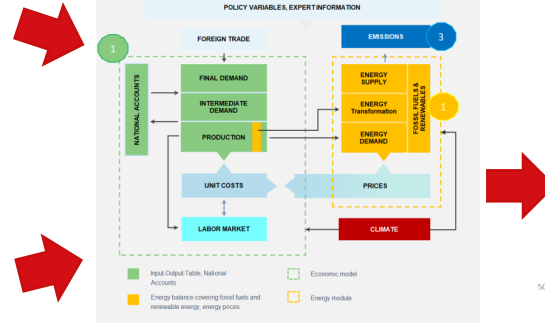
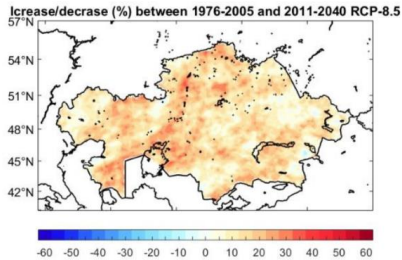
Sector	Impact	Source
	Increased government expenditures for health care services due to heat stress (+0.3%)	Own assumption based on estimations for Germany (Hübler 2014)
	Increased demand for beverages due to heat (+3%)	Own assumption based on Mirasgedis et al. 2014 and experiences in Germany during 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

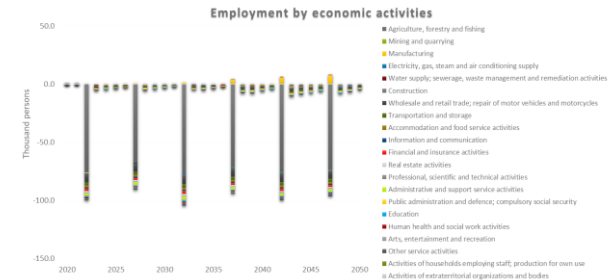
Assumption
heat waves
increase from
about 0.4 to
max. 1.2 per
year



GDP effect ↓ 1 %



Employment effect ↓ 1.1%



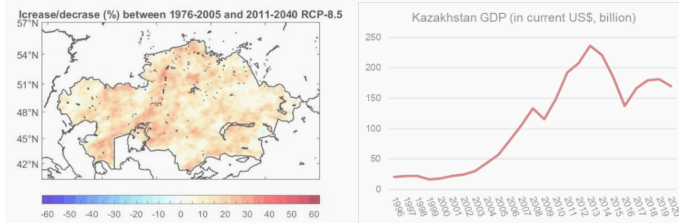
Example: Heatwaves and deployment of wind power and energy efficiency improvements in the housing sector in Kazakhstan



Scenario Analysis | Step II: Evaluation of adaptation measures

Climate & Economic Data Step I

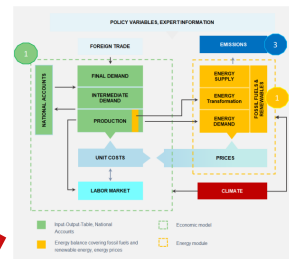
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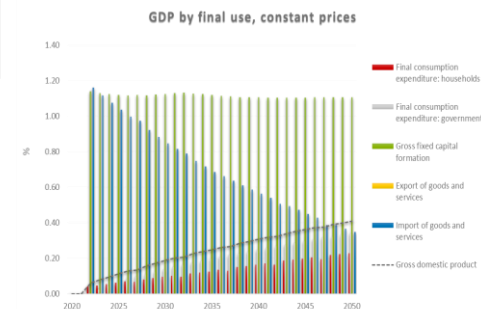
Adaptation Measures & Cost Benefit Analysis Step II

Adaptation measures	Cumulated investment (2022 – 2050)	Adaptation benefits (by 2050)
Deployment of wind power	2.9 trillion KZT ¹ (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;



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

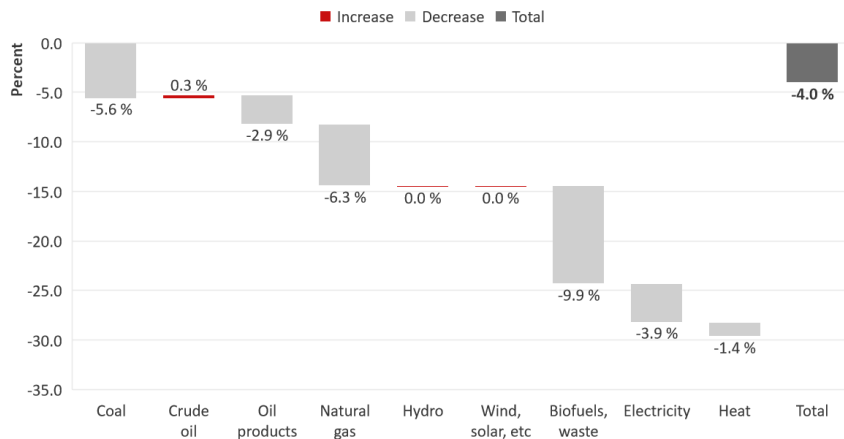




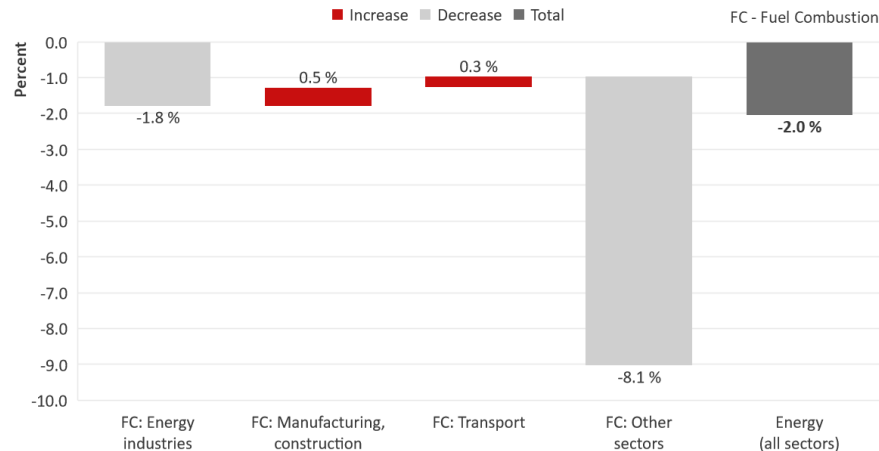
Scenario Analysis | Step II: Results for environmental indicators

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

Policy Advice for Climate-Resilient Economic Development (CRED)
Methods of assessing and planning climate-resilient economic development

With planned adaptation for climate-resilient economic development

Climate change is one of the greatest threats facing humanity, with the resulting sea-level rise and changing weather patterns. The consequences of the resulting accelerating climate change adaptation is a basic, comprehensive and economic response. This includes identifying and promoting adaptation measures, such as the temperature, that come with it, such as risk reduction, opportunities and growth in a range of fields. They are essential for ensuring that economic growth, social justice and environmental protection are not sacrificed to the climate crisis.

Therefore, the CRED programme develops overall methods for making the necessary regions of the climate change, as a result of climate-based adaptation measures, in order to ensure climate-resilient economic development in the long-term.

Assessing climate risks and improving adaptation measures

Systematic and effective adaptation measures need to be implemented to ensure the climate-resilient economic development are being as well as an improvement in existing policy and adaptation measures.

A better assessment and planning of adaptation measures enables cities to be better prepared for the climate challenges to be faced by the sectors towards a climate resilient future.

Brief on Models

Macroeconomic Models for Climate Resilience

An economic tool for adaptation and development planning

Summary

Resilient climate adaptation is development growth that is economic, equitable, the best combination between economic development and climate that best economic development path is climate resilient in the long term. An effective adaptation measure is defined as one that is effective in the long term, taking into account the effects of climate change on the different economic sectors for the results. Adaptation is a combination of the economic effects on the macroeconomic level and the economic effects on the regional level. Adaptation measures that are being planned for implementing the adaptation measures of the CRED.

Key messages

- They provide a simple economic framework for comparing economic risk impact of these financial, economic development and climate-resilient adaptation measures.
- They provide additional information on adaptation measures, in terms of GDP and employment effects for the economic sector and the climate sector. They also help to determine the climate resilience status, as a part of economic planning in National Adaptation Plan (NAP).
- They have been developed together and discussed through the exchange of various policy levels, but countries, and local levels.

If implemented well, macroeconomic models that include climate impacts from the present to future adaptation strategies that address economic and climate risks and climate-resilient economic development. They provide useful additional information for decision makers at the national level for the planning and implementation of adaptation measures, in the context of climate-resilient economic development (CRED) at www.giz.de/DE/pressroom/2018/08/180808_cred.html

This paper outlines the macroeconomic models and highlights the key findings regarding adaptation planning. It details an additional process, based on the experience of the global programme for Economic Resilient Economic Development (ERED) in the global the approach in Europe, Australia and Vietnam.

Publication

giz German Development Cooperation
of the Federal Republic of Germany

The Institut für Nachhaltige Entwicklung
of the Federal Republic of Germany

All knowledge products available on Project Website at giz: [DE/EN](http://www.giz.de/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



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