Energy and Climate Change Green Investments Forum 10th International Scientific Conference

SIM4NEXUS

cambridge econometrics

clarity from complexity

Supporting global and European climate and energy policy-making through the nexus approach

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Dr Dora Fazekas,

Eva Alexandri

Cambridge Econometrics

Agenda

- Cambridge Econometrics
- Sim4Nexus
- Nexus approach
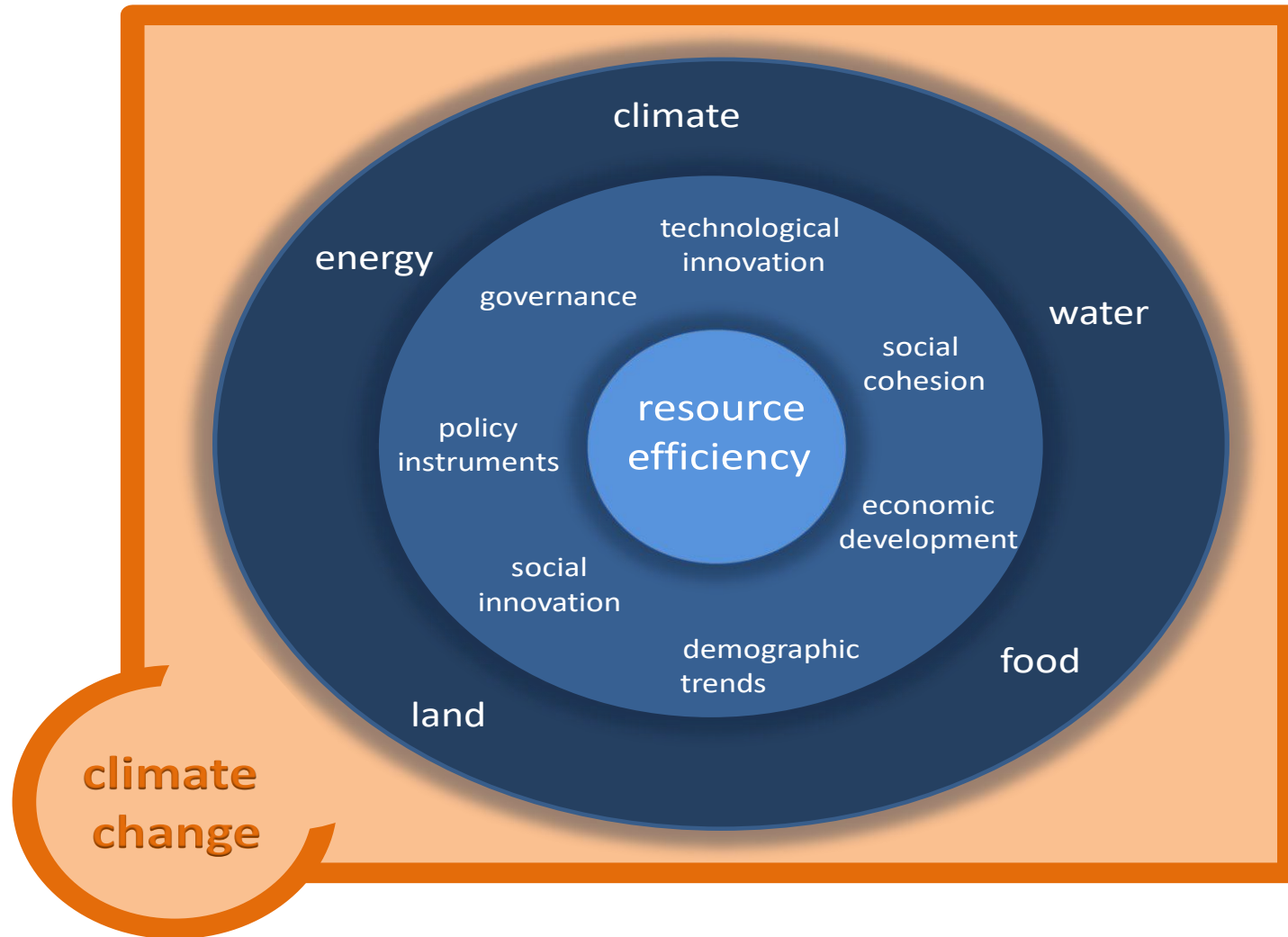- Thematic models
- Azerbaijan case study

Cambridge Econometrics (CE)

- Economic consultancy with offices in Cambridge and Brussels

- Specialise in the application of economic modelling and data analysis techniques for policy assessment and forecasting

- Thematic areas
  - macroeconomy and industries
  - energy, climate and the circular economy
  - employment and skills
  - regions, cities and local areas
  - infrastructure and economic development.
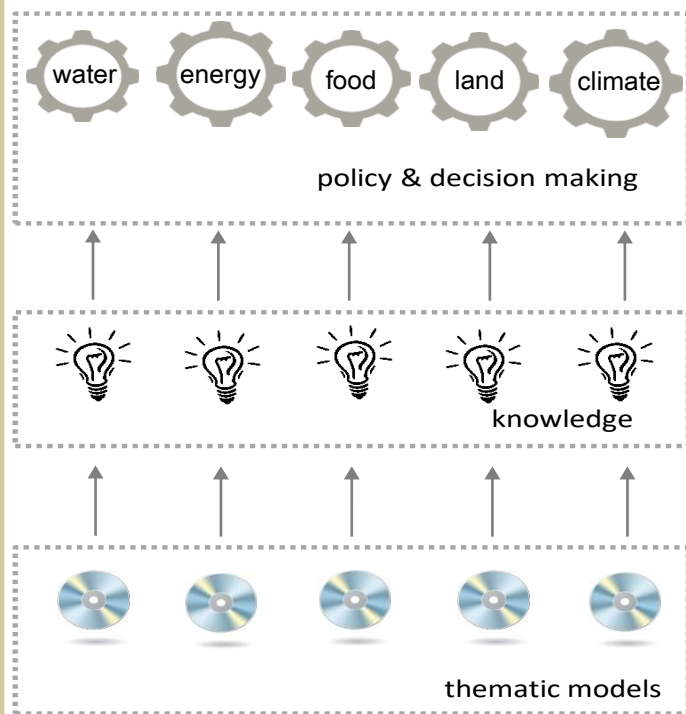
SIM4NEXUS project

- H2020
- innovative way of looking at nexus challenges and opportunities, and their use in policy assessment
- increasing cross-sectoral dimensions in European policy-making
- project aims at
  - developing innovative methodologies to facilitate the design of policies and
  - bridge knowledge and technology gaps in the field of the water-land-food-energy-climate Nexus under climate change conditions
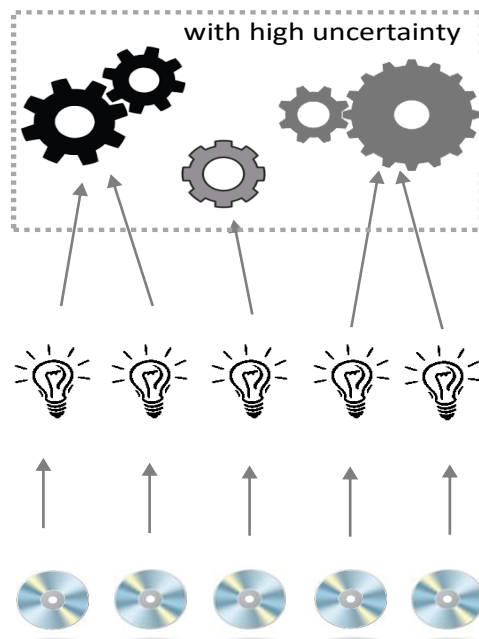
Our vision of the Nexus concept

SIM4NEXUS concept

before integration

water energy food land climate

policy & decision making

knowledge

thematic models

partial integration

with high uncertainty

Nexus with SIM4NEXUS

All Nexus components interacting with reduced uncertainty

complexity science producing integrated knowledge
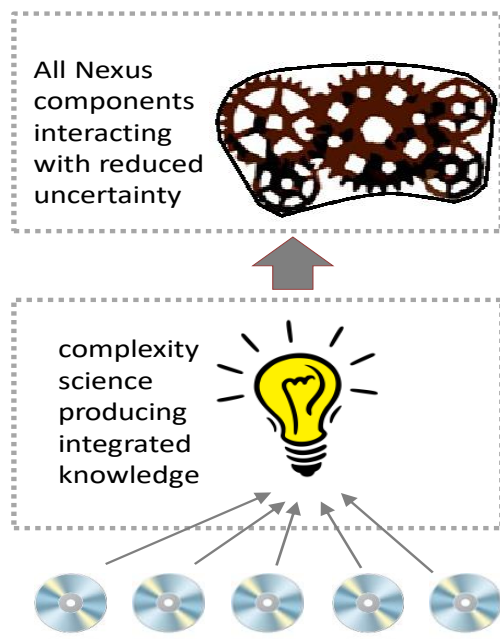
Common practice with silo-thinking, fragmented policy and decision making and R&D support

Decision making partially integrating Nexus components with high uncertainty about results

SIM4NEXUS approach: NEXUS-compliant R&D and policy-making

Thematic models

	E3ME-FTT	MAGNET	CAPRI	IMAGE-GLOBIO	OSeMOSYS	SWIM	MAgPIE-LPJmL
Nexus components	Energy, land, economy, climate	Food, land, economy, energy, climate	Food, water, env., bioenergy, climate	Land, env., water, energy	Energy, land, climate, water	Water, land, climate	Food, land, water, env., bioenergy, climate
Geo coverage	Global	Global	Global	Global	Global	River basins	Global
Spatial EU resolution	National	National	Regional (NUTS2)	Detailed grids	River basin, national	Regional, river basin	Detailed grids
Appl. to case studies	Global, EU-wide and national	Global, EU-wide and national	All	Global and European	Global and European	Transboundary	Global and European
Time step	Annual	Flexible, until 2050	Flexible, until 2050	Annual	Annual	Annual	5-year steps
Time frame	Until 2050	Until 2050	Until 2050	Until 2100	Until 2050	Until 2050	Until 2100

Thematic models used for case studies

12 case studies

representing a **diversity of scales** for decision-making, as well as **socioeconomic** and **institutional** conditions

The **selection of the thematic models** to be applied to each case study followed a **participatory and iterative process**

National Case Study
Regional Case Study
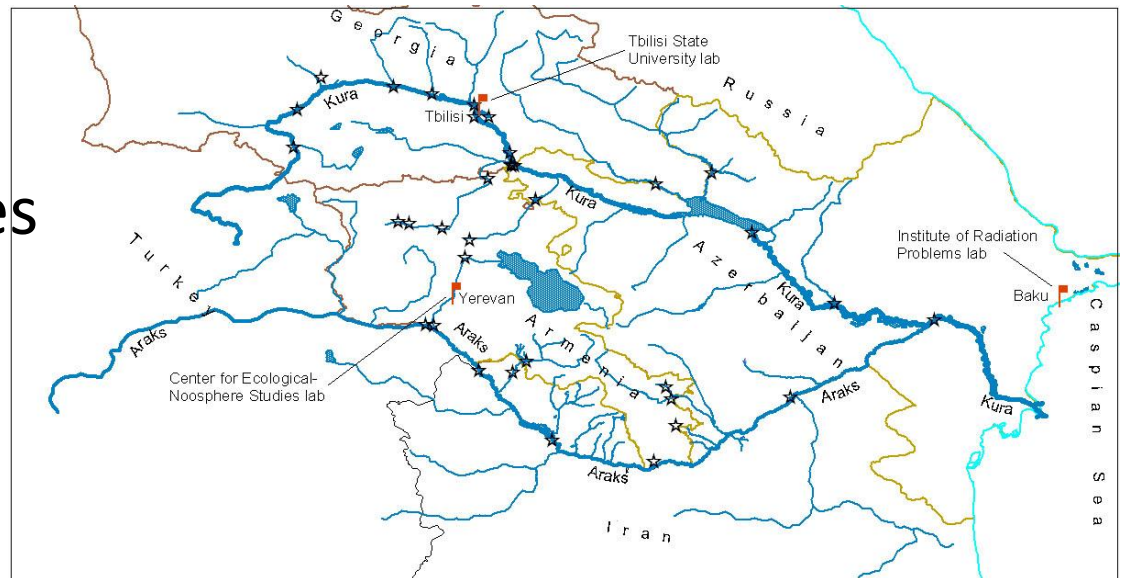
Azerbaijan
Sweden
Latvia
South West of the UK
Netherlands
Transboundary DE/CZ/SK
France-Germany
Sardinia
Greece
Andalusia

The models used in each case study

Case study	Thematic model applied						
	E3ME	MAGNET	CAPRI	IMAGE-GLOBIO	Osemosys	SWIM	magPIE-LPjML
Andalusia	xx	xx	xx				
Sardinia	xx		xx	xx*			
Southwest UK	xx		xx				
The Netherlands	xx	xx	xx				
Sweden	xx	xx	xx	xx*			
Greece	xx	xx	xx	xx*	xx		
Latvia	xx	xx	xx				
Azerbaijan	xx	xx	xx		xx		
France-Germany	xx		xx			xx	xx
Germany-Czech Republic-Slovakia			xx			xx	
Europe	xx	xx	xx	xx			xx
Global	xx	xx	xx	xx	xx		xx

E3ME is an econometric model

- An analytical tool designed to simulate interactions and dynamics of the economy

- Comprehensive: whole E3: energy-environment-eonomy system, all sectors, many policy instruments

- Open as regards economic policy, i.e. no assumptions of full employment, budget balance, or balance of payments equilibrium

- "Scenario" approach

- Treatment of uncertainty
  - in parameter estimates (econometric estimation of error distribution)
  - in assumptions and policies (by scenario analysis)

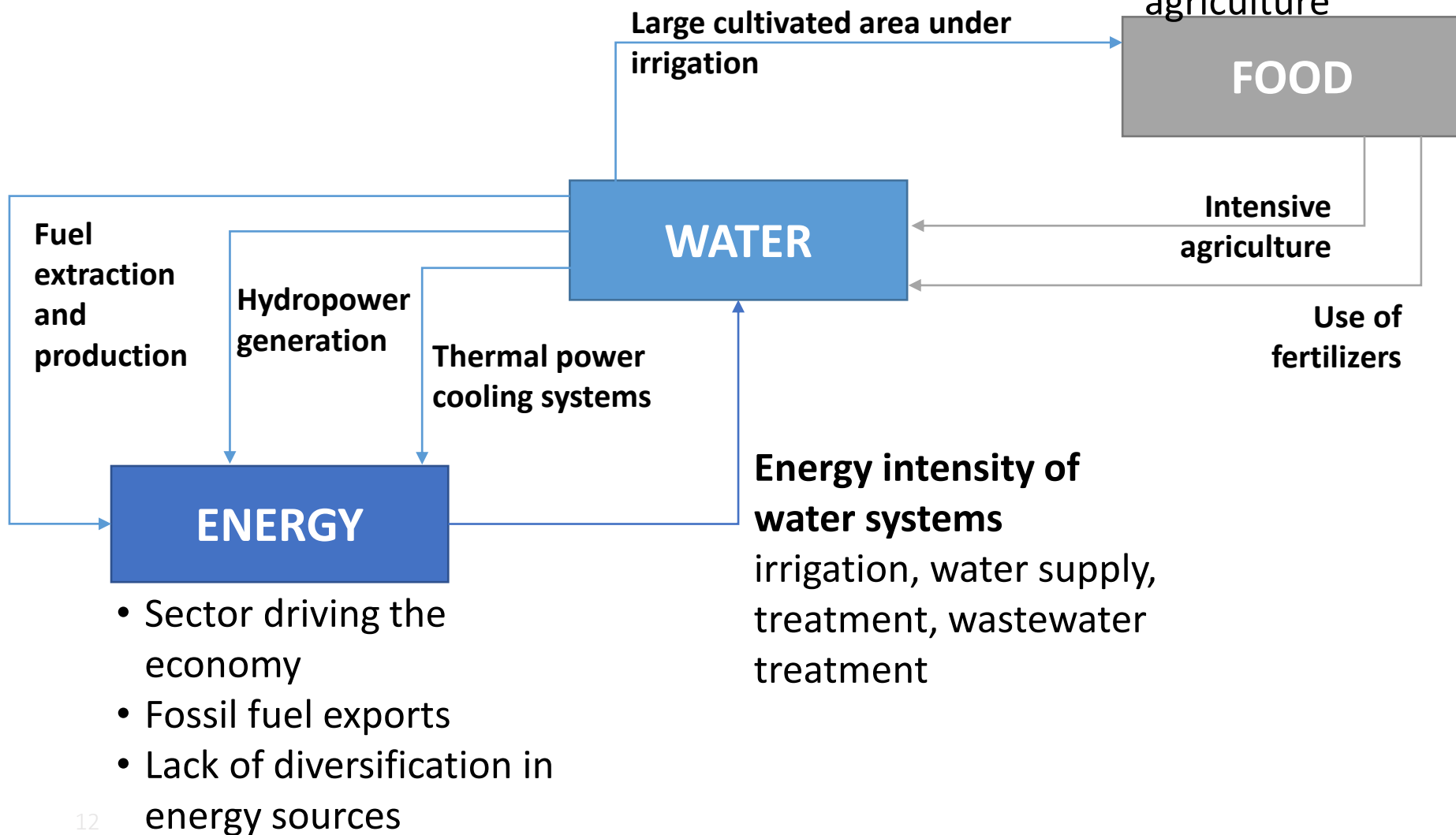- Modular, so that research can be decentralised e.g. energy submodel

Azerbaijan case study

- Transition economy relying almost entirely on income from oil and gas exports

- Drilling activity leads to externalities linked to the use of resources (water), land use (including ecosystems)

- Pursuing diversification of the economy

- Food self-reliance highly prioritized

- Share of renewables to increase

- Reforestation and crop adaptation to be considered

Sectoral and Nexus Challenges

- Important sector of the economy
- Food security issue
- 36% population employed in agriculture

Large cultivated area under irrigation

FOOD

Intensive agriculture

WATER

Fuel extraction and production

Hydropower generation

Thermal power cooling systems

Use of fertilizers

Energy intensity of water systems
irrigation, water supply, treatment, wastewater treatment

ENERGY

- Sector driving the economy
- Fossil fuel exports
- Lack of diversification in energy sources

Case study: thematic models and coverage of nexus systems

AZERBAIJAN	Thematic model applied			
Nexus system	**E3ME**	**MAGNET**	**CAPRI**	**OSeMOSYS**
Climate	X	X		X
Land Use	X	X	X (env, bioenergy)	
Energy	X	X		X
Water			X	X
Food		X	X	X
Economy	X	X		

Work progress and challenges

- Limited availability of detailed economic and energy data

- OSeMOSYS model baseline scenario developed, Working with open-source data

- MAGNET in progress

- Azerbaijan could not be put in E3ME as a separate region, as E3ME has quite high level data requirements both in terms of variables as well as level of disaggregation

- An alternative solution: single-region Input-Output model based on a very detailed IO table for 2011 from the Azerbaijan National Statistics Office, covering 81 sectors and products.

Soft-linking of the thematic models

- Integration of the thematic models' knowledge would lead to reduced uncertainty when modelling policy outcomes

- Models can be hard-linked or soft-linked depending on the way information is transferred between the models.

  - Soft linking: the user decides if and when feedback between models takes place. The information transfer is 'manual'.

  - Hard-linking: implies formal links where information is transferred without any user judgment

- Single region IO model will be soft-linked to thematic models, with one-way feedbacks.

Results from a scenario run in E3ME can inform demand changes in the single region model

- E3ME could be used to simulate EU policies leading to a decrease in EU imports of oil and gas

- outputs can be used to estimate the decrease in Azerbaijan energy exports through the single-region model

- then the results from this model could be fed into MAGNET to estimate changes to water supply and possibly land use and potential food security issue (e.g. the impact of less water used in oil extraction and potential redirection to agriculture).

- then it is possible to use the Osemosys model to get an indication of changes to the energy system in the country.

Conclusions/ Policy relevance

- The single country input-output model as a substitute for more detailed and complex economic models may be particularly interesting for the policy makers in emerging economies as this makes it possible to overcome data constraints and allows the analysis of more complex policy scenarios.

Thanks for your attention!

For further information please consult
www.sim4nexus.eu,
follow us at @SIM4NEXUS

df@camecon.com

Potential scenarios

- set of scenarios to explore would be looking at the economic impact of a decrease in demand in fossil fuel exports, particularly as a result of EU policy actions. A set of scenarios could estimate the decrease in EU oil and gas imports
  - in the case of increased support for alternative fuel vehicles,
  - the achievement of NDC targets, or
  - the more ambitious policies trying to achieve the 2C target.