SECCA
Sustainable Energy Connectivity in Central Asia

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THE ONLINE INITIAL TRAINING WORKSHOP ON ENERGY MODELLING

Online, 27 March 2025

High-level introduction to energy and climate systems analyses

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Stantec | intec | ACTED | European University Institute | Robert Schuman Centre for Advanced Studies | FSR Energy Florence School of Regulation

Decision Science

Decision Science is the collection of quantitative techniques used to inform decision-making at the individual and population levels.

Disciplines involved: risk analysis, cost-benefit and cost-effectiveness analysis, optimization / simulation modelling, and behavioral decision theory, microeconomics, statistical analysis, cognitive and social psychology, and computer and data science, …

Operations research (a field of mathematics) focuses on practical applications, it overlaps with other disciplines including industrial engineering and operations management.

Normative models advise people about how they should make "**choices**", or descriptive models, portraying how they actually make "**choices**".

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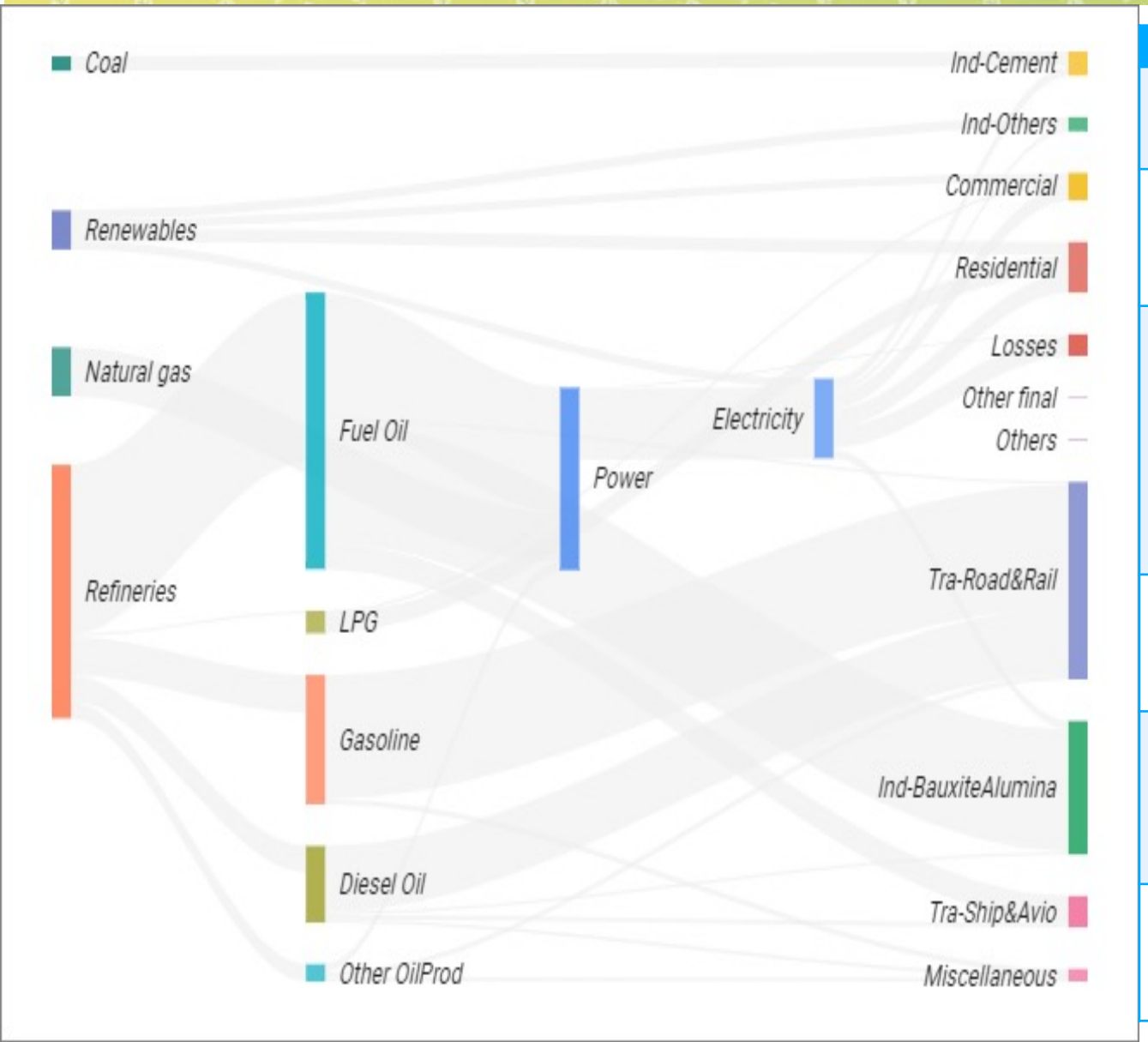
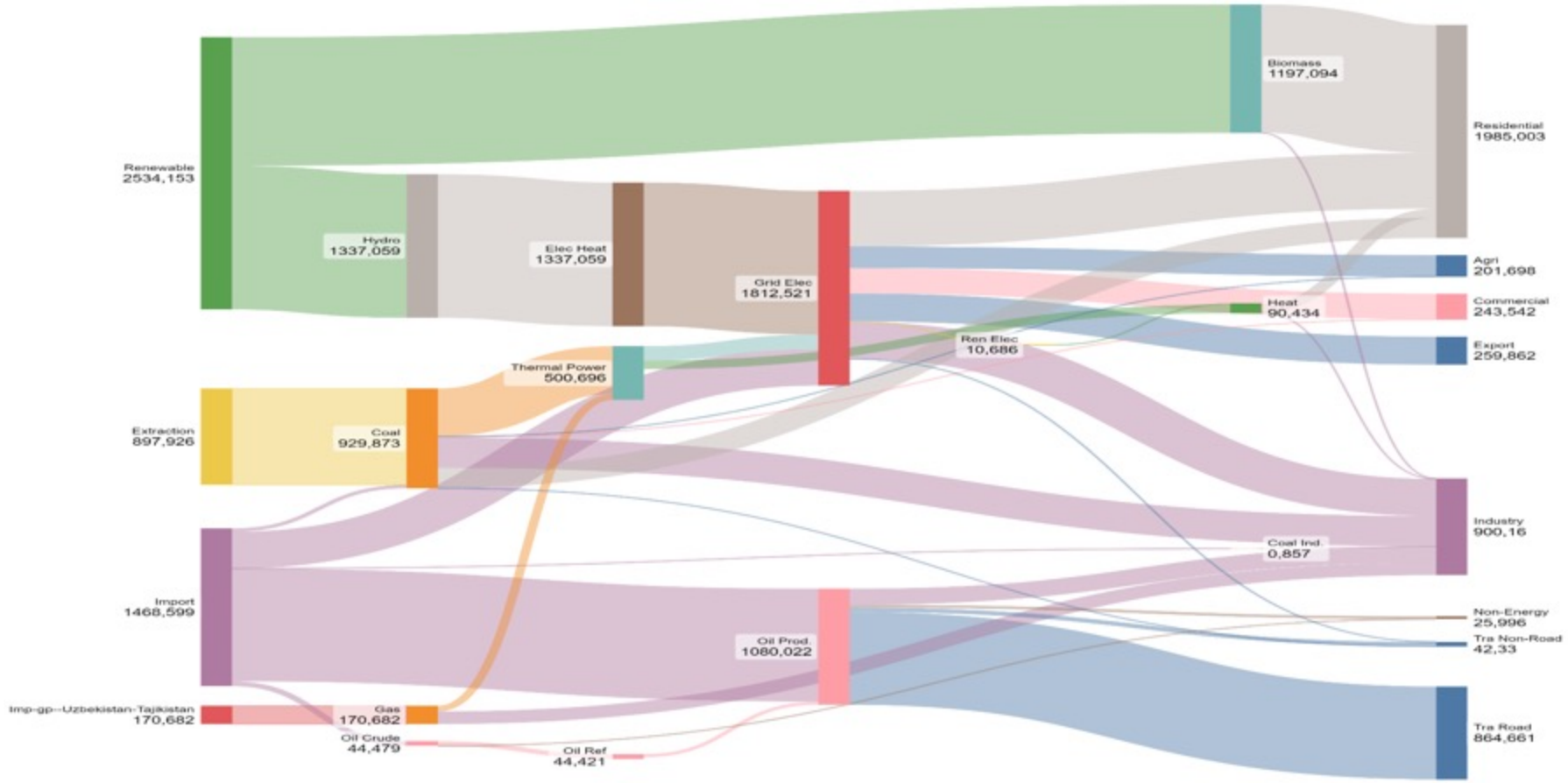
What the problem or issue is?



Key Issues	Possible Actions
Dominance of oil products in the system	Diversification of the mix
Import dependency (primary and secondary commodities)	Reduction of (financial and supply) exposure
Low share of renewable energy in the total primary energy supply (contribution of renewable energy in electricity generation accounts for around 10%)	Exploitation of domestic renewable resources
Transport and Industry are the major sectors of energy consumption	Sectoral transformations and advanced technologies
Significant electricity T&D losses (even greater than the electricity household consumption)	Refurbishment of the network and decentralised generation
Use of solid biomass for cooking (charcoal stoves)	Ensuring affordable and sustainable energy for all and improving air quality

Example: Sankey diagram – 2019 (ktoe) - Example



Link

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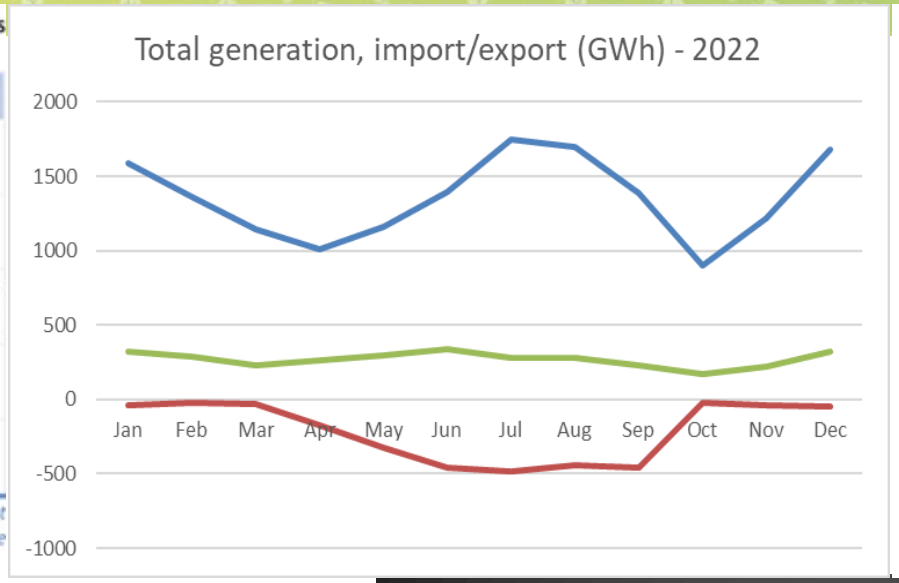
Example: Sankey diagram – 2019 (ktoe) - Example

Table 2.1 - **Targets for coal production in Tajikistan until 2040 (compilation of data from various strategic documents) and actual coal production in 2015 and 2020, million tonnes**

Source	2015	2020	2025	2030	2040
National Development Strategy of the Republic of Tajikistan, Industrial Scenario, 2016	1.0 (fact)	4.1 (target)	6.9 (target)	10.4 (target)	-
National Development Strategy of the Republic of Tajikistan, Industrial-Innovative Scenario, 2016	1.0 (fact)	5.3 (target)	10.3 (target)	15.1 (target)	-
Concept for the development of the coal industry, 2019	-	-	-	10.4 (target)	15.0 (target)
Accelerated Industrialisation Programme of the Republic of Tajikistan 2020-2025, 2020	-	2.1 (target)	2.4 (target)	-	-
National statistics	1.0 (fact)	2.0 (fact)	-	-	-

Sources: National Development Strategy of the Republic of Tajikistan until 2030, Tajikistan Coal Sector Development Concept until 2040, Accelerated Industrialisation Programme of the Republic of Tajikistan 2020-2025, data provided by the national consultant



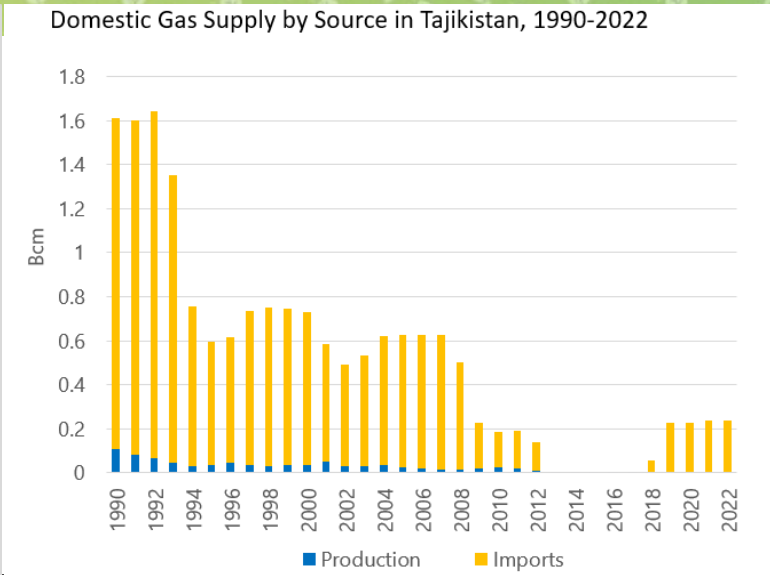
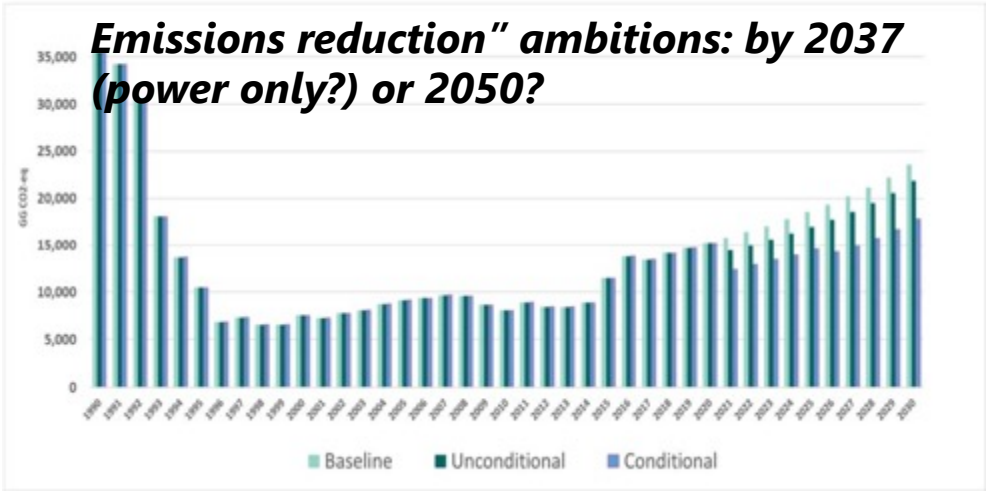
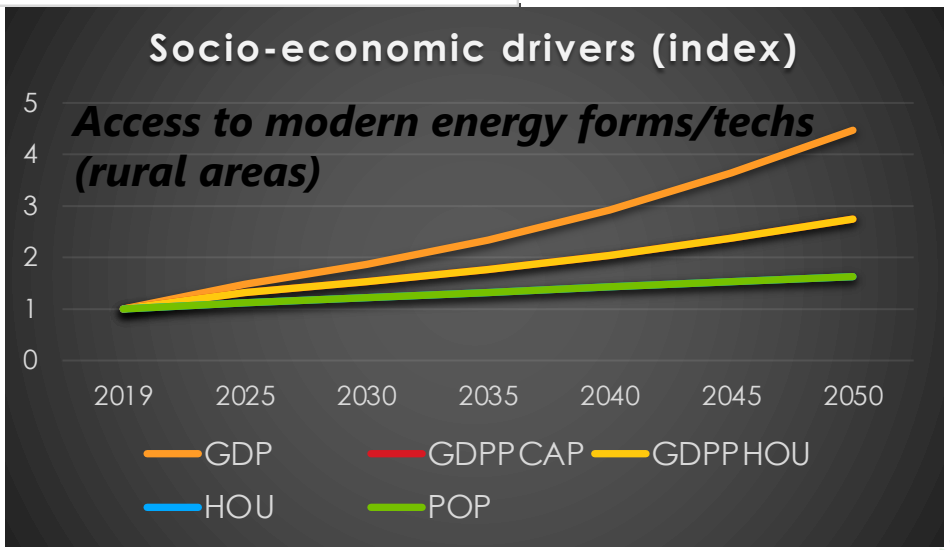


Figure 3: GHG Emissions of the Republic of Tajikistan by scenario





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Energy scenarios VS decision-makers

Issue: gap between
"theory and practice"

Goal: to share some elements/experience for your further consideration and discussion

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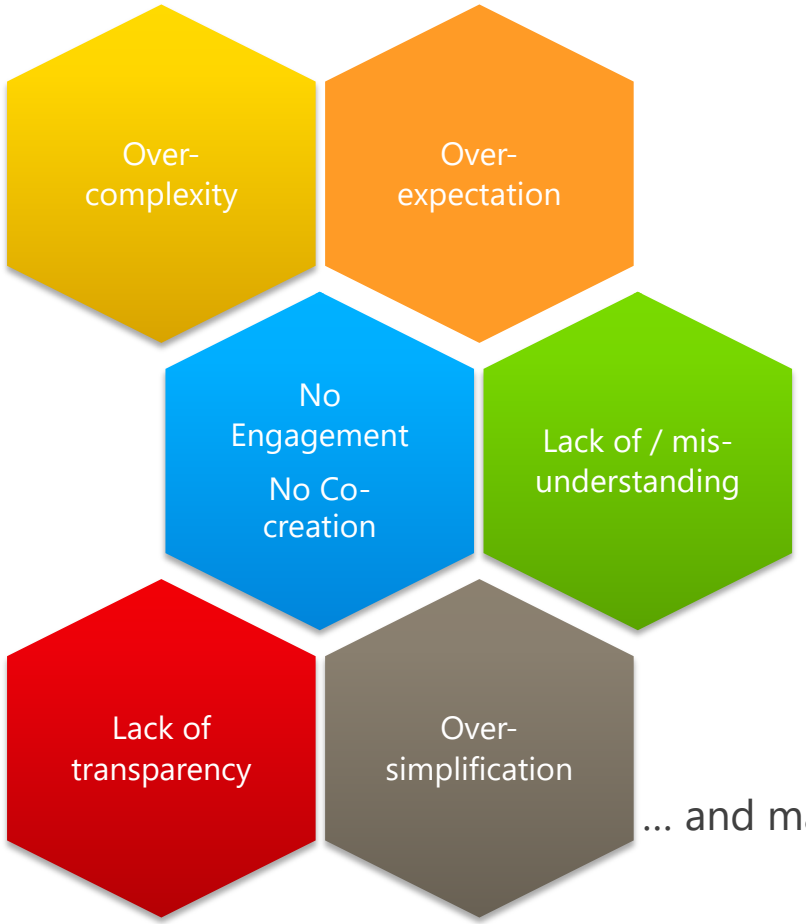
Message: No (standard/unique) methodology for developing model-based scenarios *BUT*
some "weak" practices



... and many others...

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Model-based decision support

What we do

Explorations

~~Predictions~~

What we obtain

Insights

~~Forecasts~~

What we aim for

Knowledge

~~"Truth"~~

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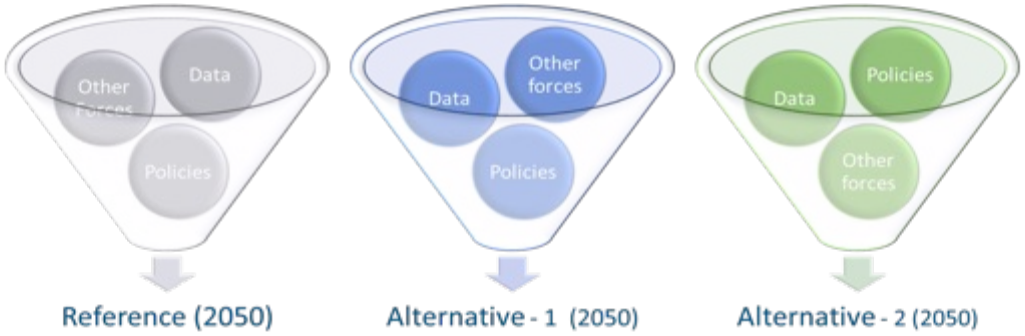
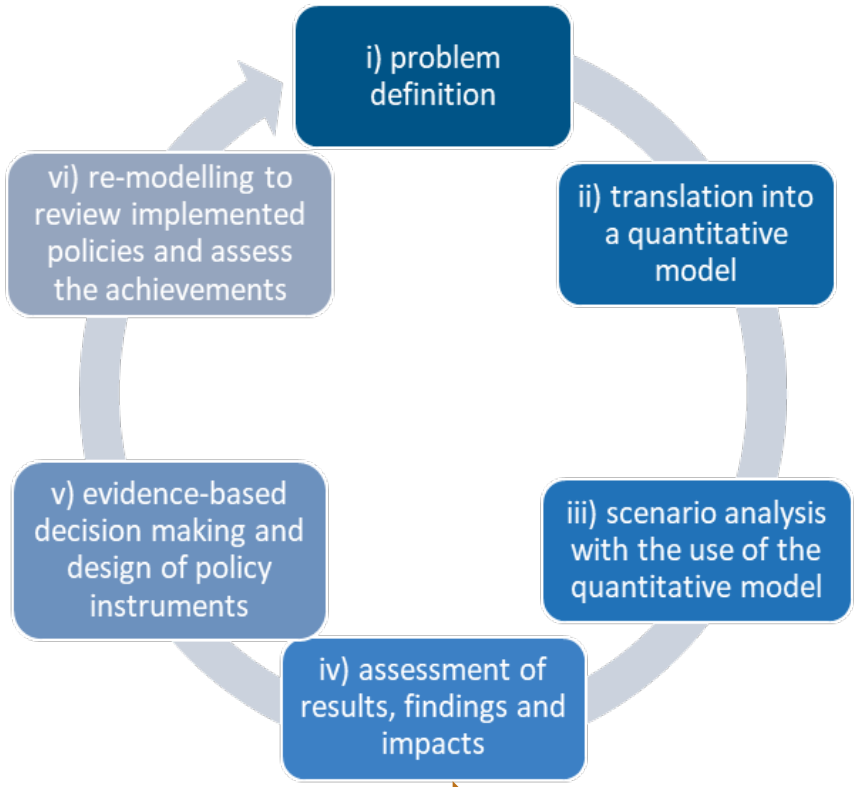
Modelling in policy development – Keyword: integration

Why do DM need/use models?

- To capture and interpret the complexity of the real world in an understandable (useful for specific scope) form
- To organise large amount of data and information (evidence-based and data-based decision making) in a structured manner.
- To (collectively) explore different assumptions and options under the same (consistent) framework/structure and trade-offs.



Multiple explorations: learning by exploring / learning by comparing`



a “robust” strategy

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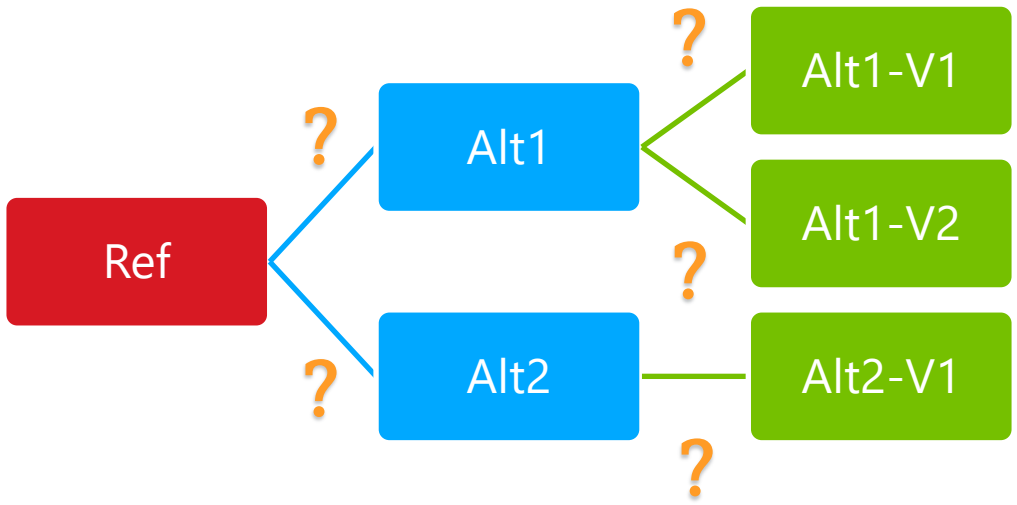
Model-based energy-climate scenarios



Energy scenarios serve as **points of comparison** to evaluate sensitivities and multiple outcomes.

Multiple explorations: learning by exploring / learning by comparing

- Integrated analysis: based on a holistic approach which addresses **simultaneously** as many perspectives or dimensions of the energy and climate dynamics as possible, and takes into account the cross-cutting nature and **interactions** between those dimensions.

In the context of this analysis we may refer more particularly to the five dimensions of the Energy Union (*Decarbonisation, Energy efficiency, Energy security, Internal energy market, Research, innovation and competitiveness*).

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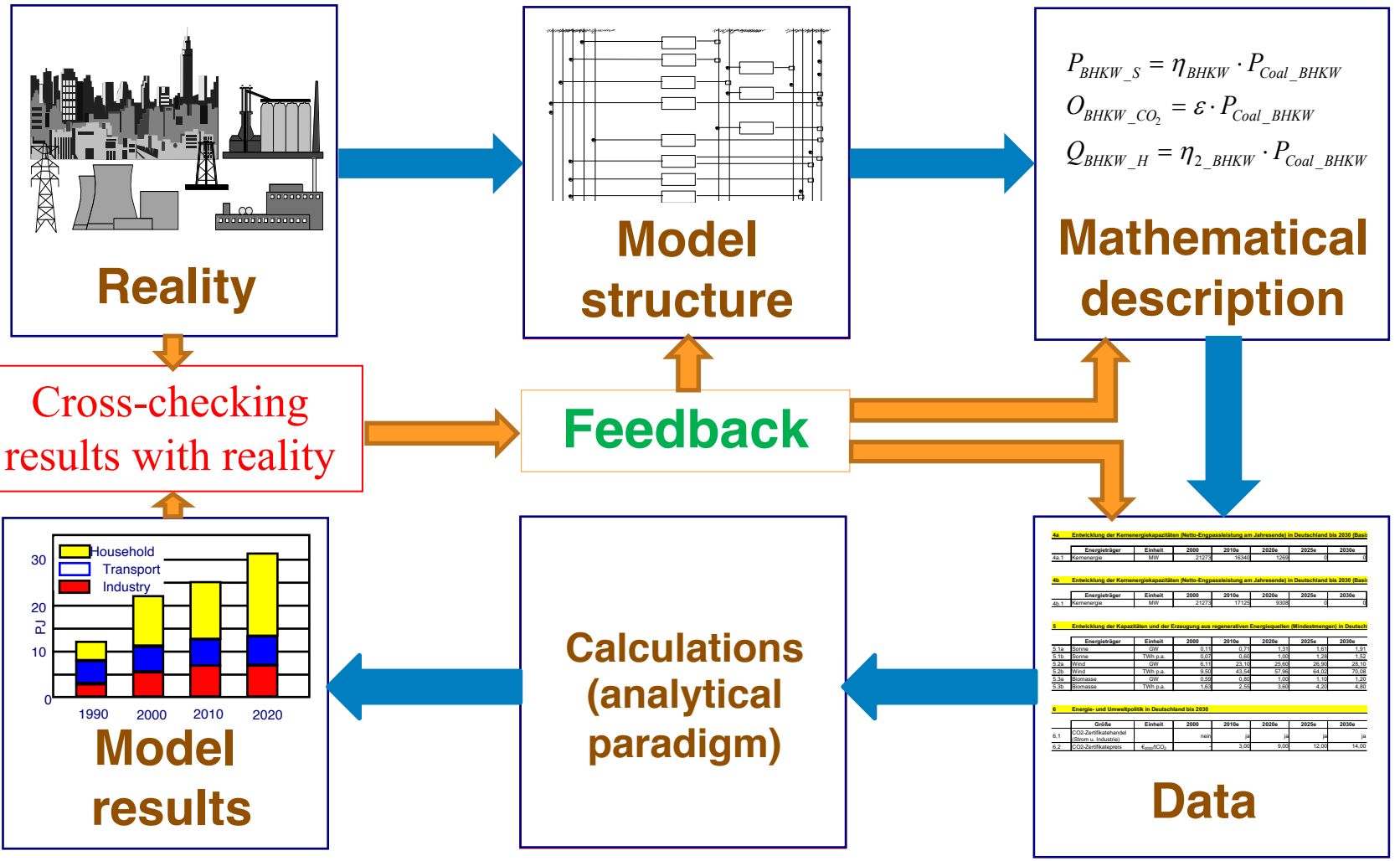
Energy system modelling – Iterative process



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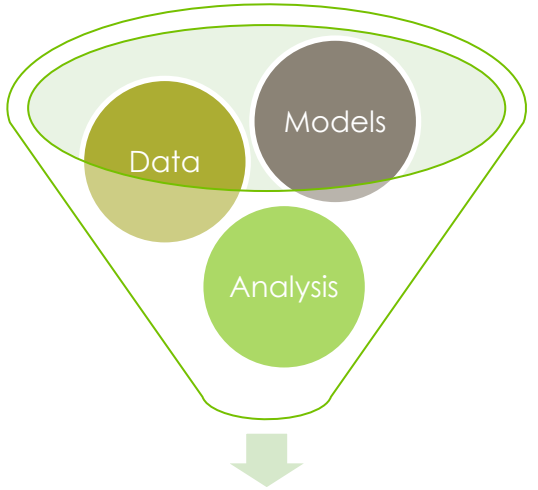
Not just about modelling

Integrated energy and climate analysis

- Data analysis and statistics
- Technology assessment
- Economic analysis
- Policy design (and simulation)
- Analysis of findings, KPIs, and visualisation
- Uncertainty analysis
- Benchmark with other studies
- …

Co-evaluation of the needs / priorities in the framework of this technical assistance
(at country- and regional-level)



SECCA outcomes

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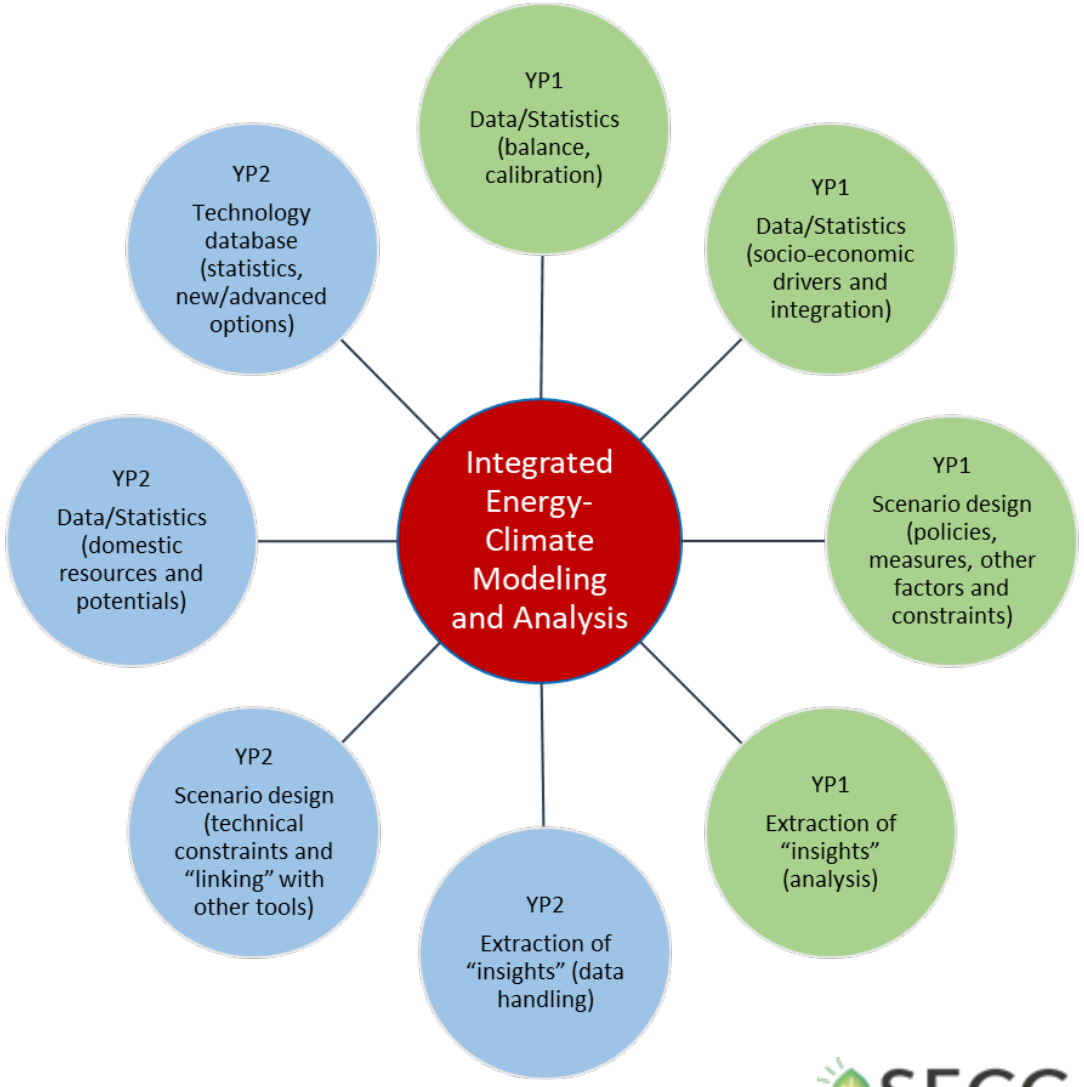
Modelling is not just about “modelling”

There is a variety of ways, approaches, (modelling) techniques to investigate the evolution of energy and climate KPIs over time. But despite the differences, all rely on a few fundamental basis and principles, like:

- *understand and interpret the complexity of real-world systems;*
- *collect, understand, organise and use data (quantitative analysis);*
- *analyse policy instruments that turn the system towards a desired state.*



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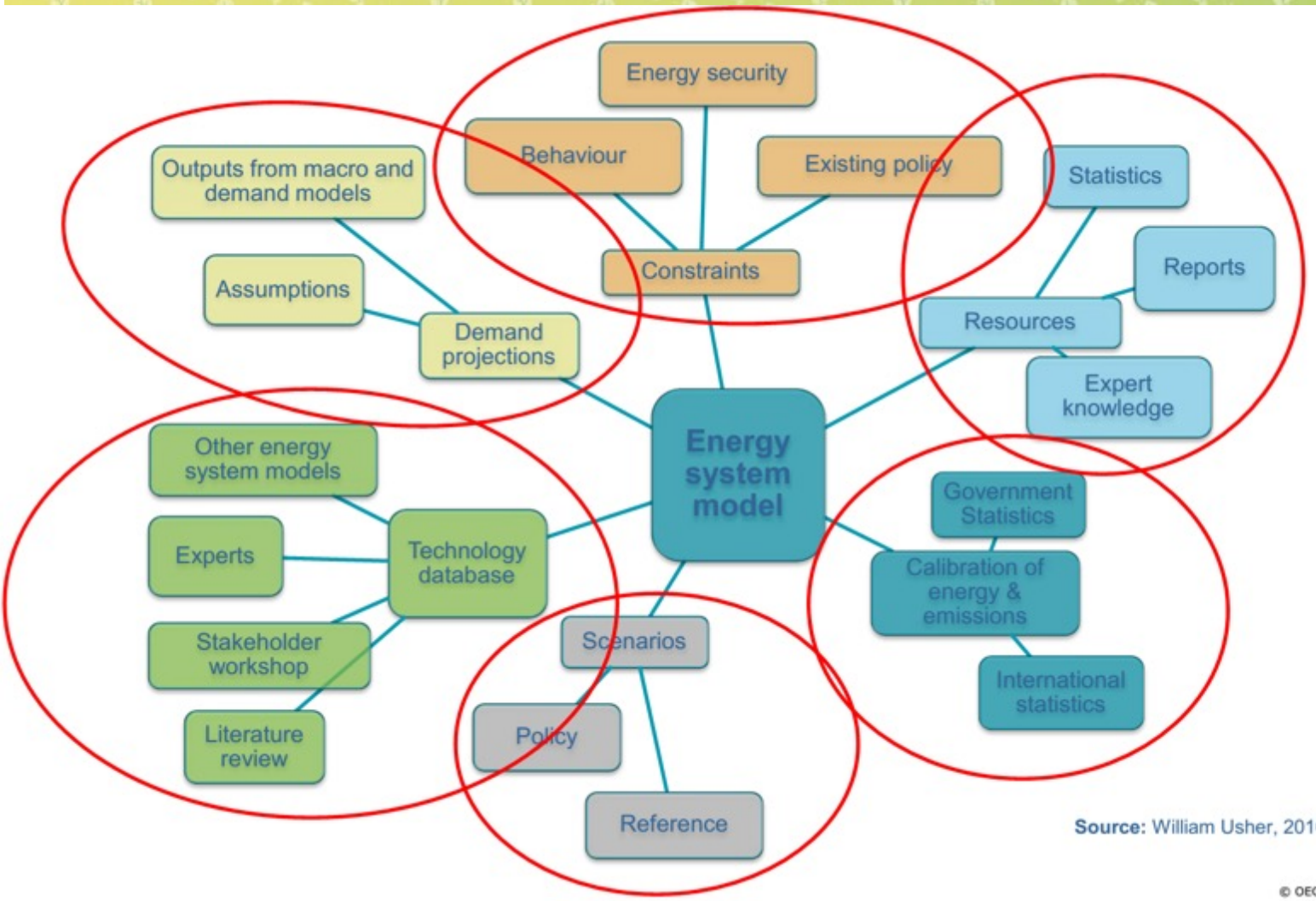

- NEB 202X
- Basic statistics (POP, #households, vehicles fleet, physical production of key industries)
- Power plants (stock, key operation parameters)
- Import and supply (coal, gas, oil products)
- Service-specific indicators / KPIs, in residential, tertiary, transport, industry
- Demand projections (Population projections, Other drivers/projections to be assumed)
- Technology Database
- Potential of RES / reserves / minerals
- Policies and other factors

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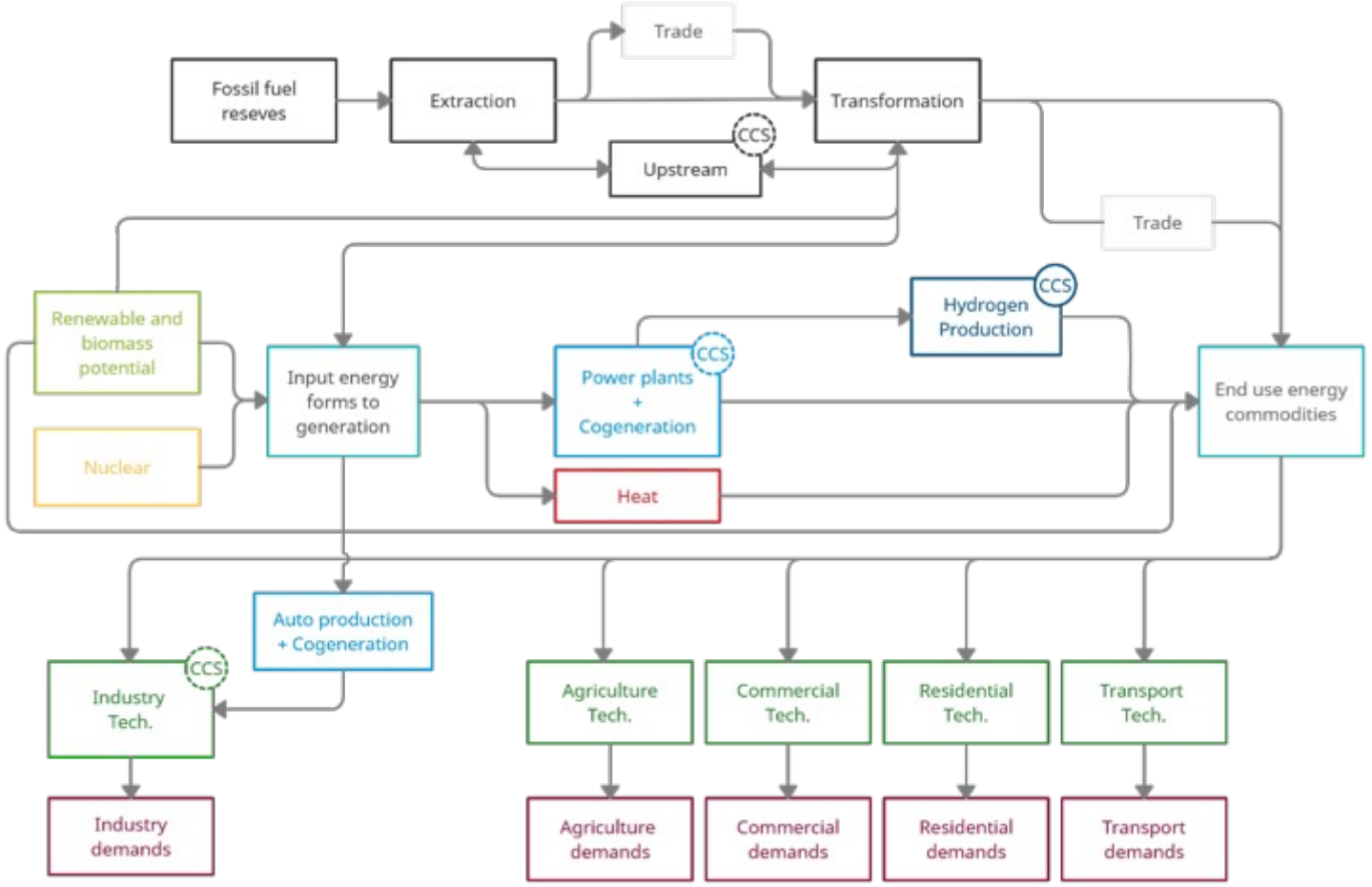
The Reference Energy System – RES – Examples (2)



Task: Translate a critical decision problem of your country into a RES scheme

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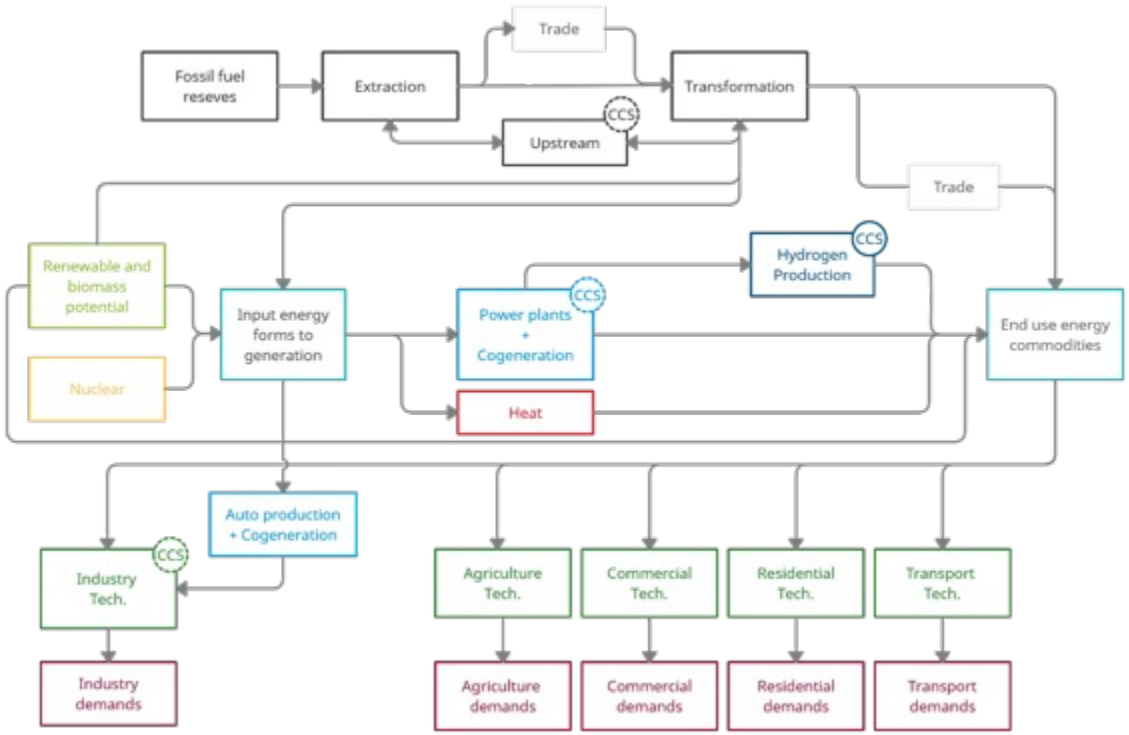
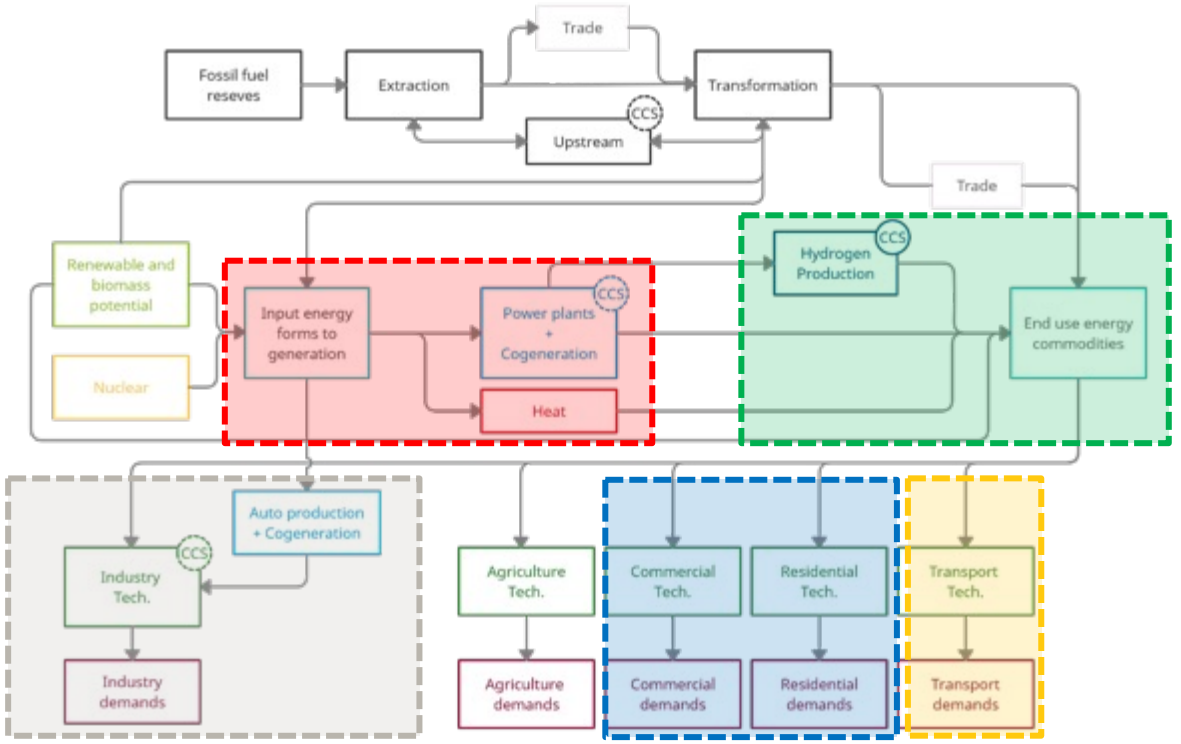
Energy systems modelling: System ≠ sum of the parts



System Analysis (Optimisation)

Energy flows and energy-related emissions per service/sector and for the whole system. Targets/measures can be analysed per service and/or sector and/or system.



Existing sector-specific analysis *(highlighted)*

Energy flows and emissions per each standalone sectoral level. No flows between/across sub-sectors.

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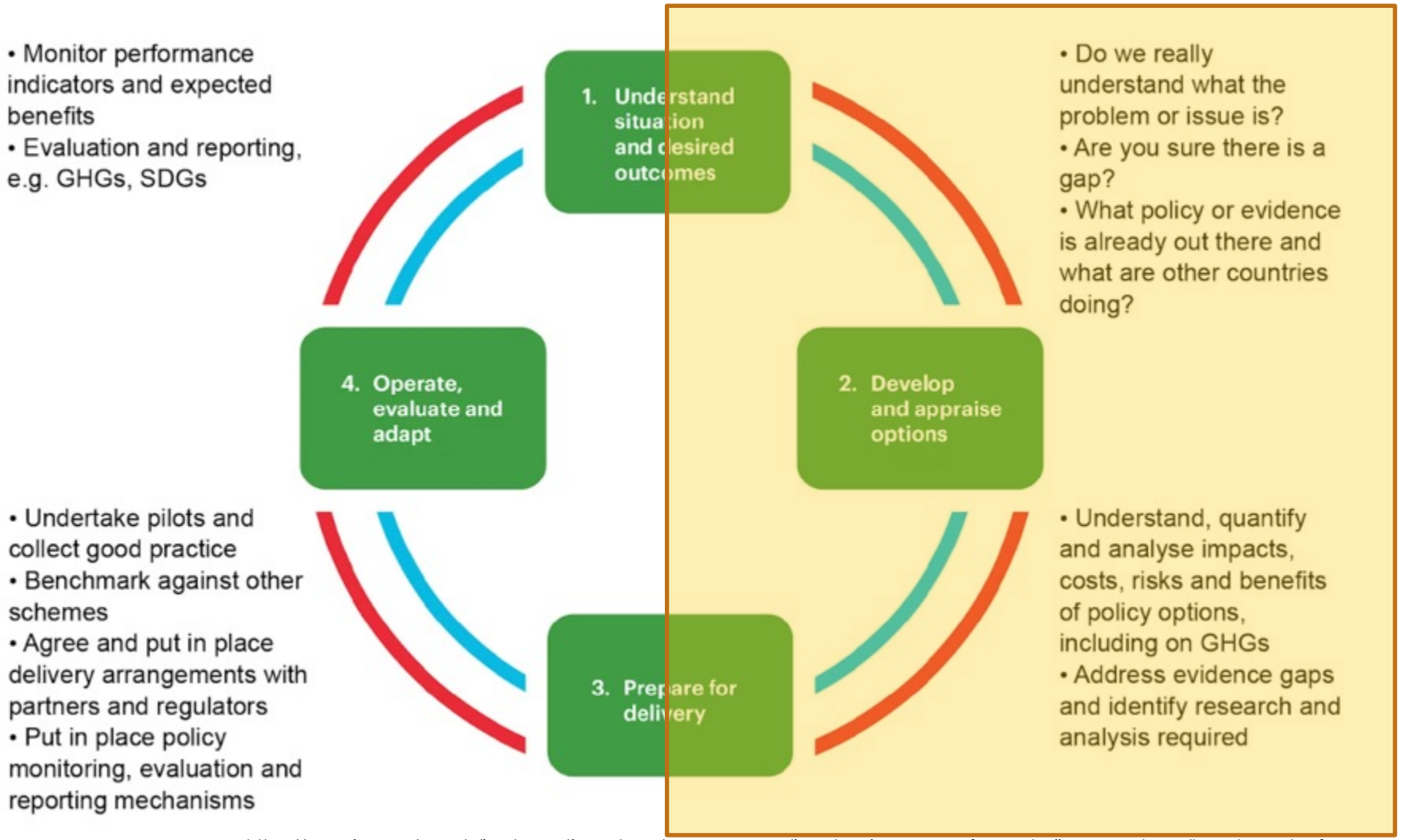
The Policy Development/Delivery Cycle



In order to be able to properly assess and evaluate these strategic goals and move into the policy-making process, the DM must call on a variety of skill sets and expertise.

Policy making needs input from all analytical professions (statisticians, economists, operational and social researchers), engineers, technical energy specialists and policy advisers.

https://www.iea.org/reports/implementing-a-long-term-energy-policy-planning-process-for-azerbaijan-a-roadmap/key-elements-of-energy-policy-planning

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